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Ventilator Length of Stay, Base Costs, and Outcomes in 2,487 Mechanically Ventilated Patients

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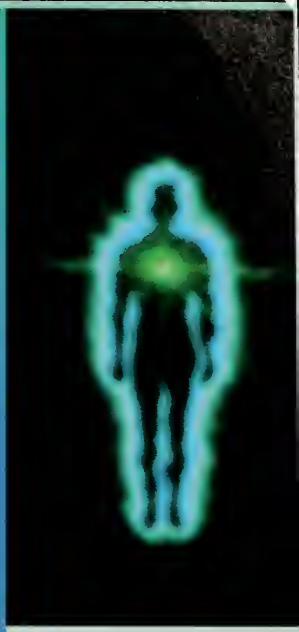

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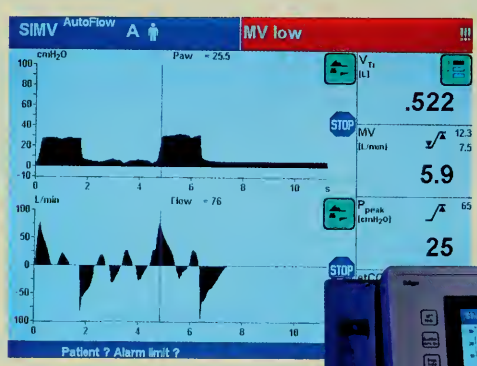

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Current Concepts: Noninvastive Ventilation (Review)—Hillberg RE, Johnson DC. N Engl J Med 1997;337(24):1746-1752.

Genetics of Asthma (Conference Summary)—Drazen JM, Silverman EK. Am J Respir Crit Care Med 1997;156(4 Pt 2):S69-S71.

Goliath and Some Davids in the Tobacco Wars (Editorial)—Susser M. Am J Public Health 1997; 87(10):1593-1595.

Informed Consent (Special Article)—Waisel DB, Truog RD. Anesthesiology 1997;87(4):968-978.

Managed Care Is not the Problem, Quality Is (Commentary)—Brook RH. JAMA 1997;278(19): 1612-1614.

Overview of Nebuliser Treatment (Historical Article)—Muers MF. Thorax 1997;52 (Suppl 2):S25-S30.

Costs of an Emergency Department-Based Accelerated Diagnostic Protocol vs Hospitalization in Patients with Chest Pain: A Randomized Controlled Trial—Roberts RR, Zalenski RJ, Mensah EK, Rydman RJ, Ciavarella G, Gussow L, et al. JAMA 1997;278(20):1670.

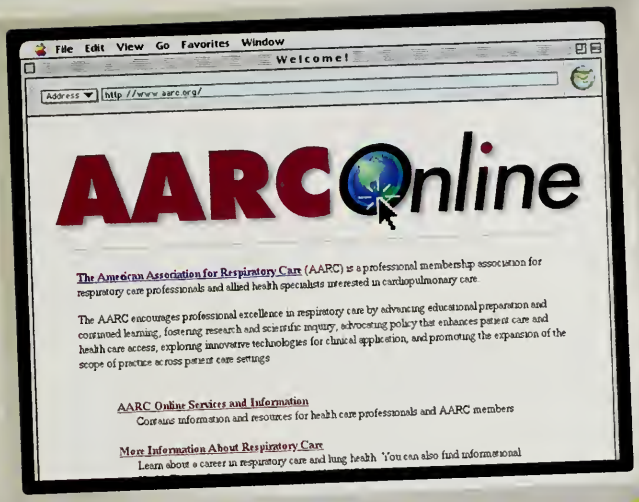
CONTEXT: More than 3 million patients are hospitalized yearly in the United States for chest pain. The cost is over $3 billion just for those found to be free of acute disease. New rapid diagnostic tests for acute myocardial infarction (AMI) have resulted in the proliferation of accelerated diagnostic protocols (ADPs) and chest pain observation units. OBJECTIVE: To determine whether use of an emergency department (ED)-based ADP can reduce hospital admission rate, total cost, and length of stay (LOS) for patients needing admission for evaluation of chest pain. DESIGN: Prospective randomized controlled trial comparing admission rate, total cost, and LOS for patients treated using ADP vs inpatient controls. Total costs were determined using empirically measured resource utilization and microcosting techniques. SETTING: A large urban public teaching hospital serving a predominantly African American and Hispanic population. PATIENTS: A sample of 165 patients was randomly selected from a larger consecutive sample of 429 patients with chest pain concurrently enrolled in an ADP diagnostic cohort trial. Eligible patients presented to the ED with clinical findings suggestive of AMI or acute cardiac ischemia (ACI) but at low risk using a validated predictive algorithm. MAIN OUTCOME MEASURES: Primary outcomes measured for each subject were LOS and total cost of treatment. RESULTS: The hospital admission rate for ADP vs control patients was 45.2% vs 100% ($p < 0.001$). The mean total cost/patient for ADP vs control patients was $1,528 vs $2,095 ($p < 0.001$). The mean LOS measured in hours for ADP vs control patients was 33.1 hours vs 44.8 hours ($p < 0.01$). CONCLUSIONS: In this trial, ADP saved $567 in total hospital costs/patient treated. Use of ED-based ADPs can reduce hospitalization rates, LOS, and total cost for low-risk patients with chest pain needing evaluation for possible AMI or ACI.

The Role of Neutrophils in the Pathogenesis of Idiopathic Pulmonary Fibrosis—Obayashi Y, Yamadori I, Fujita J, Yoshinouchi T, Ueda N, Takahara J. Chest 1997;112(5):1338.

OBJECTIVES: The prognostic value of the neutrophil count in bronchoalveolar lavage fluid (BALF) has been controversial. The role of neutrophils in this inflammatory lung disease, therefore, was evaluated in this study by additional measures. MATERIALS & METHODS: We performed bronchoalveolar lavage (BAL) in 22 patients with idiopathic pulmonary fibrosis (IPF) diagnosed by open lung biopsy specimen. Percent polymorphonuclear leukocyte (PMN) in BALF and absolute neutrophil counts were compared with those of normal nonsmokers. Elastase complexed to α-1-proteinase inhibitor (α1-PI) in plasma and BALF was measured as a marker of elastase burden, and neutrophil distribution in 22 lung tissues was observed by immunohistochemistry using antineutrophil elastase antibody. RESULTS: Percent PMN and absolute neutrophil counts in BALF did not increase in patients with IPF as compared with normal nonsmokers ($n = 15$); the plasma elastase-α1-PI complex value (mean ± SE) of patients with IPF (668.5 ± 112.4 ng/mL) was significantly high as compared with that of normal nonsmokers (130.3 ± 21.3, $p < 0.001$). In addition, the BALF elastase-α1-PI complex value (mean ± SE) of patients with IPF was also significantly high (333.1 ± 87.0 ng/mg albumin) as compared with that of normal nonsmokers (83.1 ± 29.3 ng/mg albumin, $p < 0.05$). Immunohistochemistry demonstrated considerable numbers of neutrophils infiltrating the lung parenchyma in biopsy specimens obtained by open lung biopsy. CONCLUSIONS: These results suggested that although the neutrophil count in BALF could not represent the distribution of neutrophil in the lung, high levels of neutrophil elastase were demonstrated in lung parenchyma and also in both BALF and sera. Therefore, neutrophils might indeed play an important role in the pathogenesis of IPF.

A **Randomized, Controlled Study of the 1-Hour and 24-Hour Effects of Inhaled Nitric Oxide Therapy in Children with Acute Hypoxemic Respiratory Failure**—Day RW, Allen EM, Witte MK. Chest 1997;112(5):1324.

OBJECTIVE: To determine whether 24 hours of inhaled nitric oxide improves oxygenation greater than conventional therapy alone in children with acute hypoxemic respiratory failure. DESIGN: Prospective, randomized, controlled study. SETTING: Twenty-six-bed pediatric ICU in a tertiary children's hospital. PATIENTS: Twenty-four patients with acute bilateral lung disease requiring a positive-end expiratory pressure > 6 cm H_2O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and a fraction of inspired oxygen > 0.5 for > 12 hours. INTERVENTIONS: Twelve patients were treated with 10 ppm inhaled nitric oxide from the onset of randomization and 12 control patients were initially maintained on a regimen of conventional therapy alone. After a period of 24 hours, control patients were also treated with 10 ppm inhaled nitric oxide. Hemodynamic and blood gas measurements were performed at baseline, at 1 hour after randomization, and at 24-hour intervals for 2 days. MEASUREMENTS & RESULTS: Inhaled nitric oxide decreased the ratio of pulmonary to systemic vascular resistance and improved oxygenation indexes during the initial hour following randomization. However, 24 hours after randomization, the oxygenation indexes of 11 surviving treated patients were not improved in comparison to baseline or the oxygenation indexes of 10 surviving control patients. Oxygenation indexes acutely improved in control patients when inhaled nitric oxide was started after 24 hours of conventional therapy. Oxygenation indexes remained improved in the initial control patients after 24 hours of inhaled nitric oxide. CONCLUSIONS: Pulmonary vascular resistance and systemic oxygenation are acutely improved by 10 ppm inhaled nitric oxide in some children with severe lung disease. However, a sustained improvement in oxygenation may not occur during prolonged therapy. Thus, inhaled nitric oxide may have a limited therapeutic role in children with acute hypoxemic respiratory failure.

Is pH Paper an Acceptable, Low-Cost Alternative to the Blood Gas Analyzer for Determining Pleural Fluid pH?—Lesho EP, Roth BJ. Chest 1997;112(5):1291.

BACKGROUND: Our laboratory uses pH paper rather than a blood gas analyzer to measure pleural fluid pH to decrease cost and avoid analyzer malfunction due to viscous fluids. METHODS: To compare these 2 methods of determining pleural fluid pH, 42 patients undergoing diagnostic or therapeutic thoracentesis had two 1-mL aliquots of pleural fluid anaerobically collected in a heparinized syringe and placed on ice. pH measurements were made using litmus paper (pHydron Vivid 6-8 brand litmus paper; MicroEssential Labs; Brooklyn NY) and the model 995-Hb blood gas analyzer (AVL Instruments; Roswell GA) within 1 hour of collection. Agreement analysis was performed in 3 ways: on the entire group; in subcategories of complicated or uncomplicated parapneumonic effusions (< 7.1, 7.1 to 7.3, > 7.3); and in subcategories of poor prognosis or better prognosis malignant effusions (< 7.3, > 7.3). RESULTS: pH measured with pH paper was significantly more variable (SD = 0.55, coefficient of variation [CV] = 7.5%) than was pH measured with the blood gas analyzer (SD = 0.11, CV = 1.5%). There was no significant correlation between values obtained with the 2 techniques (r = −0.26, SD of the differences = 0.59). Using the pH subcategories, there was 72% discordance in classification between litmus paper and arterial blood gas (ABG) determinations for patients with parapneumonic effusions. In patients with malignant effusions, there was 30% discordance. The pH values obtained by the ABG analyzer predicted tube thoracostomy 72% of the time, whereas the pH values obtained using pH paper were consistent only 36% of the time. CONCLUSION: Determination of pleural fluid pH using pH paper is unreliable and should not be considered an acceptable alternative to the blood gas analyzer. There is no need to determine pH on purulent samples. Hospital laboratories will be more likely to allow the use of the ABG analyzer on fluids other than blood if clinicians keep this in mind.

Home Nebulized Therapy for Patients with Chronic Obstructive Pulmonary Disease: Patient Compliance with Treatment and its Relation to Quality of Life—Corden ZM, Bosley CM, Rees PJ, Cochrane GM. Chest 1997; 112(5): 1278.

OBJECTIVES: To assess compliance with home nebulized therapy in patients with chronic obstructive pulmonary disease (COPD). DESIGN: Patients' home nebulizers were replaced with nebulizers that recorded the date and time of each treatment over a period of 4 weeks. Poor compliance was defined as taking < 70% of the prescribed dose (or < 60% for those prescribed treatments 5 or more times daily). SETTING: Patients were seen at the hospital COPD outpatient clinic. The compliance data obtained were recorded while they were at home. PATIENTS: Ninety-three patients aged 44 to 76 years (mean, 64.9 years) were recruited from the hospital nebulizer database. MEASUREMENTS: Patients completed a self-reported quality of life scale, the St George's Respiratory Questionnaire (SGRQ), both before (SGRQ1) and after (SGRQ2) the 4-week study period to look at whether quality of life was either predictive of or subsequent to level of compliance. RESULTS: Data were obtained from 82 patients. Mean compliance was 57% (range, 0 to 124%). Thirty-six (44%) patients were compliant and 46 (56%) were poorly compliant. There was no difference between the 2 groups in age or sex distribution. Compliance was negatively correlated with the total score on the SGRQ2 (p = 0.03). CONCLUSION: The study shows that levels of compliance with nebulized therapy are low in a large proportion of patients with COPD and that patients with low levels of compliance report greater impairment in their quality of life.

Influence of Sleep Apnea on 24-Hour Blood Pressure—Pankow W, Nabe B, Lies A, Becker H, Kohler U, Kohl FV, et al. Chest 1997;112(5):1253.

OBJECTIVE: To study the influence of obstructive sleep apnea (OSA) on 24-hour blood pressure (BP). SETTING: Sleep laboratory of the Medical Department, Neukolln Hospital, Berlin, Germany. METHODS: In 93 subjects, noninvasive 24-hour BP monitoring was performed with BP recordings made at 15-min intervals. Apnea severity was evaluated by means of a portable device that allows calculation of an oxygen desaturation index (ODI). A normal 24-hour BP profile (dipping) was defined by a night/day BP ratio of 0.9. RESULTS: ODI was related to systolic and diastolic daytime ($p < 0.001$) and nighttime BP ($p < 0.001$) as well as systolic and diastolic BP night/day ratios ($p < 0.001$). Multiple regression analysis showed that age and ODI were independently related to daytime BP. When subjects were grouped according to apnea severity, daytime BP increased as ODI increased: 127/80 ± 10/11 mm Hg in habitual snorers (ODI 0 to 5), 135/87 ± 15/9 mm Hg in mild OSA (ODI 6 to 30), and 140/90 ± 13/10 mm Hg in severe OSA (ODI > 30) (p values < 0.05 for comparisons of OSA groups with habitual snorers). Compared to subjects with mild OSA or habitual snorers, BP night/day ratios were greater in patients with severe OSA (p values < 0.05). Accordingly, hypertension and nondipping increased as ODI increased. CONCLUSION: OSA is associated with hypertension independent of the confounding factors of age and obesity. Nondipping is related to apnea severity. These alterations might contribute to the increased mortality in patients with severe OSA.

Influenza Virus Vaccination of Patients with Chronic Lung Disease—Gorse GJ, Otto EE, Daughaday CC, Newman FK, Eickhoff CS, Powers DC, et al. Chest 1997;112(5):1221.

STUDY OBJECTIVES: To evaluate the safety of, and mucosal and systemic immune responses induced by 2 influenza virus vaccine regimens in subjects with chronic obstructive pulmonary disease (COPD). DESIGN: Single-center, blinded, randomized, prospective clinical trial evaluating 2 vaccine regimens. SETTING: Outpatient clinics of St Louis Department of Veterans Affairs Medical Center. PARTICIPANTS: Volunteers (age range, 42 to 88 years) had preexisting COPD with severe obstruction to airflow on average, were male, and were not receiving immunosuppressive medication. INTERVENTIONS: Twenty-nine volunteers were randomly assigned to receive either bivalent live attenuated influenza A virus vaccine (CAV) or saline solution placebo intranasally. All subjects also received an i.m. injection of trivalent inactivated influenza virus vaccine (TVV) simultaneously. MEASUREMENTS & RESULTS: Clinical status and pulmonary function measured by spirometry did not change significantly after vaccination. Using hemagglutinins (H1 and H3 HA) which more closely resembled those in CAV, mean levels of anti-HA immunoglobulin A (IgA) antibodies in nasal washings increased significantly after vaccination with CAV and TVV compared to prevaccination, but they did not increase significantly after TVV and intranasal placebo. Mean levels of influenza A virus-stimulated interleukin-

2 and -4 produced by peripheral blood mononuclear cells in vitro increased significantly after administration of the combination vaccine regimen and to a lesser extent after TVV and intranasal placebo compared to respective prevaccination levels. The timing of the cytokine response appeared different following CAV and TVV compared to TVV and intranasal placebo. CONCLUSIONS: Intranasally administered CAV was safe when given with i.m. administered TVV and there may be an immunologic advantage to administration of the combination vaccine regimen compared to TVV with intranasal placebo.

Consumer Reports in Health Care. Do They Make a Difference in Patient Care?—Longo DR, Land G, Schramm W, Fraas J, Hoskins B, Howell V. JAMA 1997;278(19):1579.

CONTEXT: Consumer reports in health care are a relatively recent phenomenon. Primarily designed to assist consumers in making more informed decisions about their personal health care, they appear to have an important by-product—they led to positive changes in the behavior of clinicians and health care delivery organizations. While there has been much speculation on their impact on health care consumer behavior, consumer reports offer an effective strategy in improving the quality of patient care. OBJECTIVE: To examine the impact of an obstetrics consumer report developed and issued by the Missouri Department of Health on hospital behavior. DESIGN & SETTING: A retrospective study of hospital behavior using both primary survey and secondary clinical data. PARTICIPANTS: Consumer reports were issued in 1993 to all Missouri hospitals providing obstetrical services (n = 90). A survey was conducted a year later, and the results were analyzed with other available data to determine the effect of the report. Two hospitals discontinued obstetrical services by the time of the survey; of the remaining 88 hospitals, 82 (93%) responded to the survey. MAIN OUTCOME MEASURES: The following outcomes were examined: (1) number and percentage of hospitals that previously did not have services at the time report was issued, but had, or planned to have, services after a guide was published; (2) the percentage of obstetrical policies that were changed, planned to change, or are under discussion for change (car seat program, obstetrical follow-up services, formal transfer agreement, nurse educator for breast-feeding, and availability of tubal ligations); and (3) clinical outcomes, including satisfaction, appropriateness of charges, and the rates of cesarean delivery, high-risk infant transfer, ultrasound, vaginal birth after cesarean, very low birthweight, and newborn death. RESULTS: Within 1 year of the report, approximately 50% of hospitals that did not have car seat programs, formal transfer agreements, or nurse educators for breast-feeding prior to the report either instituted or planned to institute these services. Hospitals in competitive markets that did not offer

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one of these services at the time of the report were more likely to institute a service and/or were about twice as likely to consider improving several indicators. Clinical outcome indicators all improved in the expected direction. CONCLUSION: Public release of consumer reports may be useful not only in assisting consumers to make informed health care choices, but also in facilitating improvement in the quality of hospital services offered and care provided. Changes occur especially in competitive markets.

Factors Influencing the Tracheal Fluctuation of Inhaled Nitric Oxide in Patients with Acute Lung Injury—Umamaheswara Rao GS, Gallart L, Law-Koune JD, Lu Q, Puybasset L, Cluzel P, et al. Anesthesiology 1997;87(4):823.

BACKGROUND: Inhaled nitric oxide (NO) improves arterial oxygenation in patients with acute lung injury (ALI) by selectively dilating pulmonary vessels perfusing ventilated lung areas. It can be hypothesized that NO uptake from the lung decreases with increasing ventilation perfusion mismatch. This study was undertaken to determine the factors influencing the fluctuation of tracheal NO concentration over the respiratory cycle as an index of NO pulmonary uptake in patients with ALI. METHODS: By using a prototype system (Opti-NO) delivering a constant flow of NO only during the inspiratory phase, 3 and 6 ppm of NO were administered during controlled mechanical ventilation into a lung model and to 11 patients with ALI. All patients had a thoracic computed tomography (CT) scan. Based on an analysis of tomographic densities, lungs were divided into 3 zones: normally aerated (−1.000 to −500 Hounsfield units [HU]), poorly aerated (−500 to −100 HU), and nonaerated (−100 to +100 HU), and the volume of each zone was computed. Concentrations of NO in the inspiratory limb and trachea were continuously measured by a fast-response chemiluminescence apparatus. RESULTS: In the lung model, tracheal NO concentration was stable with minor fluctuation. In contrast, in patients, tracheal NO concentration fluctuated widely during the respiratory cycle (55 ± 10%). Because uptake of NO from the lungs was absent in the lung model but present in the patients, this fluctuation was considered as an index of pulmonary uptake of NO. This was further substantiated by (1) the coincidence of the peak and minimum tracheal NO concentration with the end-inspiratory and end-expiratory phases, respectively, and (2) continued decrease of tracheal NO concentration during prolonged expiratory phase. In patients with ALI, the fluctuation of tracheal NO concentration expressed as the difference between inspiratory and expiratory NO concentrations divided by inspiratory NO concentration was greater at 6 ppm than at 3 ppm ($p < 0.01$), was linearly correlated with normally aerated lung volume, inversely correlated with alveolar dead space and with poorly aerated lung volume. CONCLUSION: In patients with ALI, fluctuation of tracheal NO concentration over the respiratory cycle can be considered as an index of NO uptake from the lungs that depends on aerated lung volume and perfusion of ventilated lung areas. At bedside, it may be used to follow the evolution of ventilation-perfusion mismatch.

Peer Review of the Quality of Care. Reliability and Sources of Variability for Outcome and Process Assessments—Smith MA, Atherly AJ, Kane RL, Pacala JT. JAMA 1997;278(19): 1573.

CONTEXT: Peer assessments have traditionally been used to judge the quality of care, but a major drawback has been poor interrater reliability. OBJECTIVES: To compare the interrater reliability for outcome and process assessments in a population of frail older adults and to identify systematic sources of variability that contribute to poor reliability. SETTING: Eight sites participating in a managed care program that integrates acute and long-term care for frail older adults. PATIENTS: A total of 313 frail older adults. DESIGN: Retrospective review of the medical record with 180 charts randomly assigned to 2 geriatricians, 2 geriatric nurse practitioners, or 1 geriatrician and 1 geriatric nurse practitioner and 133 charts randomly assigned to either a geriatrician or a geriatric nurse practitioner. MAIN OUTCOME MEASURES: Interrater reliabilities for structured implicit judgments about process and outcomes for overall care and care for each of 8 tracer conditions (eg, arthritis). RESULTS: Outcome measures had higher interrater reliability than process measures. Five outcome measures achieved fair to good reliability (more than 0.40), while none of the process measures achieved reliabilities more than 0.40. Three factors contributed to poorer reliabilities for process measures: (1) an inability of reviewers to differentiate among cases with respect to the quality of management, (2) systematic bias from individual reviewers, and (3) systematic bias related to the professional training of the reviewer (ie, physician or nurse practitioner). CONCLUSIONS: Peer assessments can play an important role in characterizing the quality of care for complex patients with multiple interrelated chronic conditions, but reliability can be poor. Strategies to achieve adequate reliability for these assessments should be applied. These strategies include emphasizing outcomes measurement, providing more structured assessments to identify true differences in patient management, adjusting systematic bias resulting from the individual reviewer and their professional background, and averaging scores from multiple reviewers. Future research on the reliability of peer assessments should focus on improving the ability of process measures to differentiate among cases with respect to the quality of management and on identifying additional sources of systematic bias for both process and outcome measures. Explicit recognition of factors influencing reliability will strengthen efforts to develop sound measures for quality assurance.

Nosocomial Respiratory Syncytial Virus Infection in Canadian Pediatric Hospitals: A Pediatric Investigators Collaborative Network on Infections in Canada Study—Langley JM, LeBlanc JC, Wang EEL, Law BJ, MacDonald NE, Mitchell I, et al. Pediatrics 1997;100(6):943.

OBJECTIVE: To determine nosocomial transmission of respiratory syncytial virus (RSV) in Canadian pediatric hospitals, outcomes associated with nosocomial disease, and infection control practices. Design. A prospective cohort study in the 1992 to 1994 winter respiratory seasons. SETTING: Nine Canadian pediatric university-affiliated hospitals. PARTICIPANTS: Hospitalized children with symptoms of lower respiratory tract infection (at least one of cough, wheezing, dyspnea, tachypnea, and apnea) and RSV antigen identified in a nasopharyngeal aspirate. RESULTS: Of 1,516 children, 91 (6%) had nosocomial RSV (NRSV), defined as symptoms of lower respiratory tract infection and RSV antigen beginning > 72 hours after admission. The nosocomial ratio (NRSV/[community-acquired RSV CARSV)] + NRSV) varied by site from 2.8% to 13%. The median length of stay attributable to RSV for community-acquired illness was 5 days, but 10 days for nosocomial illness. Four children with NRSV (4. 4%) died within 2 weeks of infection, compared with 6 (0.42%) with CARSV (relative risk = 10.4, 95% confidence interval: 3.0, 36.4). All sites isolated RSV-positive patients in single rooms or cohorted them. In a multivariate model, no particular isolation policy was associated with decreased nosocomial ratio, but gowning to enter the room was associated with increased risk of RSV transmission (incidence rate ratio 2.81; confidence interval: 1.65, 4.77). CONCLUSIONS: RSV transmission risk in Canadian pediatric hospitals is generally low. Although use of barrier methods varies, all sites cohort or isolate RSV-positive patients in single rooms. Children with risk factors for severe disease who acquire infection nosocomially have prolonged stays and excess mortality.

Cost-Effectiveness of the Clinical Practice Recommendations in the AHCPR Guideline for Smoking Cessation. Agency for Health Care Policy and Research—Cromwell J, Bartosch WJ, Fiore MC, Hasselblad V, Baker T. JAMA 1997; 278(21):1759.

CONTEXT: The Agency for Health Care Policy and Research (AHCPR) published the Smoking Cessation: Clinical Practice Guideline in 1996. Based on the results of meta-analyses and expert opinion, the guideline identifies efficacious interventions for primary care clinicians and smoking cessation specialty providers. OBJECTIVE: To determine the cost-effectiveness of clinical recommendations in AHCPR's guideline. DESIGN: The guideline's 15 recommended smoking cessation interventions were analyzed to determine

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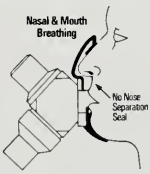

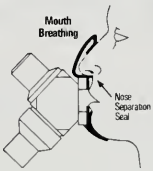

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their relative cost-effectiveness. Then, using decision probabilities, the interventions were combined into a global model of the guideline's overall cost-effectiveness. PATIENTS: The analysis assumes that primary care clinicians screen all presenting adults for smoking status and advise and motivate alt smokers to quit during the course of a routine office visit or hospitalization. Smoking cessation interventions are provided to 75% of U.S. smokers 18 years and older who are assumed to be willing to make a quit attempt during a year's time. INTERVENTION: Three counseling interventions for primary care clinicians and 2 counseling interventions for smoking cessation specialists were modeled with and without transdermal nicotine and nicotine gum. MAIN OUTCOME MEASURE: Cost (1995 dollars) per life-year or quality-adjusted life-year (QALY) saved, at a discount of 3%. RESULTS: The guideline would cost $6.3 billion to implement in its first year. As a result, society could expect to gain 1.7 million new quitters at an average cost of $3,779/quitter, $2,587/life-year saved, and $1,915 for every QALY saved. Costs/QALY saved ranged from $1,108 to $4,542, with more intensive interventions being more cost-effective. Group intensive cessation counseling exhibited the lowest cost/QALY saved, but only 5% of smokers appear willing to undertake this type of intervention. CONCLUSIONS: Compared with other preventive interventions, smoking cessation is extremely cost-effective. The more intensive the intervention, the lower the cost/QALY saved, which suggests that greater spending on interventions yields more net benefit. While all these clinically delivered interventions seem a reasonable societal investment, those involving more intensive counseling and the nicotine patch as adjuvant therapy are particularly meritorious.

Respiratory Syncytial Virus Immune Globulin Treatment of RSV Lower Respiratory Tract Infection in Previously Healthy Children—Rodriguez WJ, Gruber WC, Groothuis JR, Simoes EAF, Rosas AJ, Lepow M, et al. Pediatrics 1997; 100(6):937.

OBJECTIVE. To evaluate the efficacy of high titer respiratory syncytial virus (RSV) immune globulin (RSVIG) in the treatment of previously healthy children hospitalized with proven RSV lower tract infection (LRI). Method. Infants and young children ≤ 2 years of age with RSV LRI of ≤ 4 days duration, and respiratory scores ≥ 2.5 were enrolled. RESULTS. One hundred one previously healthy children hospitalized with RSV LRI received either 1500 mg/kg of RSVIG (RespiGam, MedImmune Inc, Gaithersburg MD) or albumin placebo in a randomized, double-blind, placebo-controlled trial. Forty-six RSVIG and 52 recipients of placebo met all eligibility criteria. Demographic characteristics of the 2 groups were similar. More RSVIG recipients (46% vs 29%) had an $S_aO_2 \leq 85\%$ at entry than did placebo recipients, but a higher proportion of placebo recipients required intensive care unit (ICU) care and mechanical ventilation at study entry. The mean RSV hospital stay was 5.52 ± 0.69 days (SE) for placebo and 4.58 ± 0.40 days for RSVIG. Additionally, there was an interaction between treatment group and entry respiratory score, which led to subgroup analysis. Children with modest respiratory illness did not receive any benefit from RSVIG therapy. RSVIG recipients with more severe illness (entry respiratory scores ≥ 3.0) had 1.6 fewer hospital days and 2.7 days less ICU stays. CONCLUSION. RSVIG infusions seemed safe and generally well tolerated. Although some beneficial effect trends were seen for those with more severe disease who were treated there was no evidence that treatment with RSVIG resulted in reduced hospitalization and reduced ICU stays in all children with RSV disease.

Mortality Attributable to Cigarette Smoking in China—Lam TH, He Y, Li LS, Li LS, He SF, Liang BQ. JAMA 1997;278(18):1505.

CONTEXT: The few published prospective studies of smoking and mortality in China have reported low relative risks, but the durations of fol-

low-up were short. OBJECTIVE: To assess the mortality of ever- and never-smokers in a cohort after 20 years of follow-up. DESIGN, SETTING, & SUBJECTS: A cohort analytic study in a machinery factory in Xi'an, China, involving 1,696 people aged 35 years or older (1,124 men and 572 women) examined in May 1976. MAIN OUTCOME MEASURES: All-cause and tobacco-associated mortality. RESULTS: A total of 56% of the men and 12% of the women were ever-smokers at baseline. Through August 31, 1996, 218 persons (173 men and 45 women) had died. The relative risks (95% confidence intervals [CIs]) for ever smoking (after adjusting for age, marital status, occupation, education, diastolic blood pressure, and triglyceride and cholesterol levels) for deaths resulting from all causes, all cancer, and coronary heart disease were, respectively, 2.42 (95% CI, 1.72-3.42), 2.50 (95% CI, 1.41-4.43), and 3.61 (95% CI, 1.35-9.67) in men and 2.32 (95% CI, 1.18-4.56), 1.98 (95% CI, 0.50-7.92), and 4.67 (95% CI, 0.78-27.8) in women. CONCLUSIONS: Previous prospective studies of smoking-related mortality in China tended to underestimate the risks, probably because of short durations of follow-up. We have demonstrated that smoking is a major cause of death in China, and the risks are similar to those seen in the United States and the United Kingdom. Thus, about half of the 300 million smokers in China will eventually die of smoking-related diseases if urgent tobacco-control measures are not instituted to prevent this growing epidemic. *See the related editorial:* ***Beyond the Clouds—Tobacco Smoking in China—*** *Mackay J. JAMA 1997;278(18):1531-1532.*

Long-Term Efficiency of Home Nasal Mask Ventilation in Patients with Diffuse Bronchiectasis and Severe Chronic Respiratory Failure: A Case-Control Study—Benhamou D, Muir JF, Raspaud C, Cuvelier A, Girault C, Portier F, et al. Chest 1997;112(5):1259.

The aim of this study was to evaluate long-term efficacy and tolerance of nasal mask ventilation (NMV) in a comparative case-control study. Fourteen patients with diffuse bronchiectasis and severe chronic respiratory failure (CRF), treated by long-term oxygen-therapy (LTO) and NMV, were case matched with 14 patients with diffuse bronchiectasis and severe CRF treated with only LTO. Patients and control subjects were compared based on the following parameters: blood gases, FEV_1, vital capacity, hospitalizations, and survival. Symptoms, Karnofsky function score, and clinical evolution were also monitored in patients. Three subgroups may be identified according to outcome: 2 early deaths (Subgroup 1), 6 patients with initial improvement and subsequent deterioration (Subgroup 2), and 6 patients whose conditions remained improved for > 2 years (Subgroup 3). P_{aO_2} decrease slope was slighter in this last subgroup than Subgroup 2. The days of hospitalization were significantly reduced after institution of NMV in the patient group. Comparison between patients and control subjects did not show any difference on P_{aO_2} evolution and on the overall median survival (46 and 40 months in NMV and control group, respectively). Long-term tolerance and compliance remained satisfactory for 11 patients. These results suggest that NMV is feasible as a long-term home treatment in patients with diffuse bronchiectasis. Although our results may have failed to prove a long-term efficiency on the course of blood gases and survival, a beneficial effect is observed with reduction of hospitalizations and improvement of functional status. This study warrants further investigation, in a prospective series, with a larger number of patients.

Pharmacokinetics and Safety of Tobramycin after Once-Daily Administration in Patients with Cystic Fibrosis—Bates RD, Nahata MC, Jones JW, McCoy K, Young G, Cox S, et al. Chest 1997;112 (5):1208.

OBJECTIVE: Tobramycin is commonly used to treat respiratory tract infections in patients with cystic fibrosis. We designed a study to determine the pharmacokinetics and safety of once-daily dosing of tobramycin in this population. DESIGN: Multiple blood samples were collected from each patient, and serum concentrations of tobramycin were determined by a fluorescence polarization immunoassay. Blood urea nitrogen and serum creatinine levels were measured every 2 to 3 days, and audiometric evaluations were performed at the start and end of therapy. MEASUREMENTS AND RESULTS: Eighteen patients (mean age, 24.6 y) received tobramycin at doses of 7 to 15 mg/kg/d as a single-dose infusion over 20 min. The maximum serum concentration of tobramycin ranged from 40.1 to 64.6 mg/L. A mean dose of 11.9 ± 1.9 mg/kg was needed to obtain a theoretical mean peak serum concentration of 42.4 ± 4.5 mg/L. The mean total body clearance, appar-

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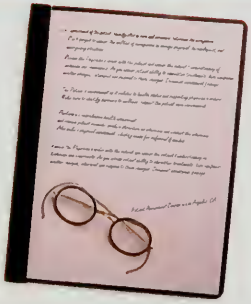

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AARC Assessment Course/Examination Detailed Content Outline

1. Obligations of the Respiratory Care Practitioner in the Practice of Patient Assessment
- A. Appreciate the cost of care
- B. Understand the scope and limitations of the practitioners role in patient assessment
- C. Understand the principle of patient self-determination
- D. Appreciate the psychological, social, and physical characteristics of wellness/illness
- E. Recognize the patient's right to confidentiality
- F. List the principles of informed consent

▶ "Assessment of the patient isn't purely clinical anymore — helped to start the 'Thinking outside the box concept,' that is necessary for continued survival of RT as a profession."

2. Perform a Comprehensive Health Assessment
- A. Review patient records
- B. Structure an interview
- C. Conduct an interview
- D. Conduct a physical assessment
- E. Identify needs for referral
- F. Identify patients with potential for high risk medical complications
- G. Accurately document assessment findings
- H. Present findings to a physician

▶ "I truly believe that assessment (total — not just physical) is what will keep our profession a vital portion of the health care team."

3. Assess the Caregivers
- A. Identify sites of care and caregivers
- B. Interview the caregivers
- C. Assess the abilities of caregivers to manage physical, technological, and emergency situations
- D. Assess home health resources

4. Assess the Patient's Understanding and Compliance with Physician's Orders and Care Plan
- A. Review the physician's order with the patient
- B. Assess the patient's understanding of technique and components

▶ "I plan on sending other staff who will be involved in asthma case management to the April '98 course in Dallas"

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▶ "I traveled ten hours to get here and feel it was well worth the trip. Your program is great."
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C. Assess patient ability to administer treatments, use equipment, monitor changes, interpret and respond to those changes
D. Document assessment findings

5. Assess the Patient's Environment as It Relates to Health Status and Supporting Physician's Orders
A. Identify barriers to wellness

▶ "The course was relevant to the changes in health care and my practice. Well worth my time."

B. Inspect the patient care environment
C. Determine the resources available to the patient and family
D. Document assessment findings

▶ "Bravo for a job well done. I plan to share a lot of this information with staff."

6. Assess Continued Appropriateness of Physician Orders and Care Plan
A. Review physician orders
B. Evaluate the patient's response to physician orders
C. Evaluate the appropriateness of the orders and the care plan
D. Recommend modification of the treatment plan
E. Document assessment findings

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ent volume of distribution, and elimination half-life was 1.7 ± 0.4 mL/min/kg, 0.27 ± 0.06 L/kg, and 1.8 ± 0.3 hours, respectively. The period of time that the serum concentration exceeded 8 times the theoretical minimum inhibitory concentration of 1 mg/L ranged from 2.1 to 4.4 hours, which was nearly 5 times longer compared with the use of divided daily doses in the same patients during previous hospitalizations. No nephrotoxicity, ototoxicity, or adverse effects occurred in any patient. CONCLUSION: Based on our data, tobramycin may be used safely in once-daily doses to treat exacerbations of respiratory tract infections in patients with cystic fibrosis.

Early Health Effects of the Emerging Tobacco Epidemic in China. A 16-Year Prospective Study—Chen ZM, Xu Z, Collins R, Li WX, Peto R. JAMA 1997;278(18):1500.

CONTEXT: In recent decades, there has been a rapid and substantial increase in tobacco consumption in China, particularly by men, but little is known from local epidemiologic studies about the pattern of smoking-related deaths. OBJECTIVE: To assess the current health effects of cigarette smoking in Shanghai, China. DESIGN: Prospective observational study of mortality in relation to cigarette smoking. SETTING: Eleven factories in urban Shanghai. SUBJECTS: A total of 9,351 adults (6,494 men and 2,857 women) aged 35 to 64 years at baseline survey during the 1970s. OUTCOME MEASURES: All-cause and cause-specific mortality. RESULTS: During an average follow-up of 16 years, 881 men and 207 women died. Among men, 61% had described themselves as current cigarette smokers at baseline, and their overall mortality was significantly greater than that of nonsmokers (relative risk [RR], 1.4; 95% confidence interval [CI], 1.2-1.7; $p < 0.001$). The excess was almost twice as great (RR, 1.8; 95% CI, 1.5-22; $p < 0.001$) among the men who had begun smoking before the age of 25 years and was significantly associated with the number of cigarettes smoked ($p < 0.001$ for trend) after adjustment for other major risk factors. The chief sources of the excess were lung cancer (RR, 3.8; 95% CI, 2.1-6.8; $p < 0.001$), esophageal cancer (RR, 3.6; 95% CI, 1.2-10.5; $p = 0.02$), liver cancer (RR, 2.0; 95% CI, 1.1-3.7; $p = 0.03$), coronary heart disease (RR, 1.8; 95% CI, 1.0-3.2; $p = 0.04$), and chronic obstructive pulmonary disease (RR, 2.5; 95% CI, 1.4-4.4; $p < 0.01$). Among the men in this Chinese population, about 20% (95% CI, 12%-29%) of all deaths during the study period could be attributed to cigarette smoking. Of these deaths, one third involved lung cancer, one third involved other cancers, and one third involved other diseases. Only 7% of women described themselves as current cigarette smokers at baseline, but among them there was also a statistically significant excess of overall mortality (RR, 1.7; 95% CI, 1.2-2.5; $p < 0.01$). CONCLUSIONS: Cigarette smoking is already a major cause of death in China, and among middle-aged Shanghai men, about 20% of all deaths during the 1980s were due to smoking. The excess was greatest among men who began smoking before the age of 25 years, about 47% of whom would, at 1987 mortality rates, die between the ages of 35 and 69 years (compared with only 29% of nonsmokers). These estimates reflect the consequences of past smoking patterns. The future health effects of current smoking patterns are likely to be greater because of the recent large increase in cigarette consumption, particularly at younger ages, in China. *See the related editorial:* ***Beyond the Clouds—Tobacco Smoking in China****—Mackay J. JAMA 1997;278(18): 1531-1532.*

Chapter 7: Asthma—Lemanske RF Jr, Busse WW. JAMA 1997;278(22):1855.

For unknown reasons, the morbidity and mortality from asthma are increasing in many parts of the world, making it a global health concern. The heterogeneous nature of the clinical manifestations and therapeutic responses of asthma in both adult and pediatric patients indicate that it may be more of a syndrome rather than a specific disease entity. Numerous factors, including viral infections, allergen and irritant exposure, and exercise, among others, complicate both the short- and long-term management of asthma. Therapeutic intervention has focused on the appreciation that airway obstruction in asthma consists of bronchial smooth muscle spasm and variable degrees of airway inflammation characterized by edema, mucous secretion, and the influx of a variety of inflammatory cells. Choosing appropriate medications depends on the disease severity (intermittent, mild persistent, moderate persistent, severe persistent), patterns of disease activity (exacerbations related to viruses, allergens, exercise, etc), and the age at onset (infancy, childhood, adulthood).

Chapter 8: Outcomes Analysis in Asthma—Blaiss MS. JAMA 1997;278(22):1874.

Physicians, patients, employers, managed care organizations, insurance companies, and government all want to know how different approaches to management of asthma are improving care. To this end, the field of outcomes analysis in asthma is playing a major role. Clinical, physiologic, humanistic, and economic outcomes are being assessed using different types of general and asthma-specific instruments. Historically, clinical and physiologic outcomes have been of most concern to clinicians. However, humanistic outcomes, such as health-related quality of life and patient satisfaction, shift the focus to the patient. Economic outcomes, especially cost-effectiveness, evaluate how to achieve the best outcomes at the lowest cost. These outcomes have been used to evaluate asthma intervention programs. Several large asthma outcomes research projects, which should define the future of outcomes analysis in asthma, are under way.

Characteristics and Outcomes of Patients Who Self-Extubate from Ventilatory Support: A Case-Control Study—Atkins PM, Mion LC, Mendelson W, Palmer RM, Slomka J, Franko T. Chest 1997;112(5):1317.

OBJECTIVE: To identify factors associated with the occurrence of deliberate self-extubation and to describe associated patient outcomes. DESIGN: Case-control study. SETTING: ICUs of a national referral, tertiary medical center. PARTICIPANTS: Fifty adult, intubated patients who had self-extubated from mechanical ventilatory support. Two control subjects who had not self-extubated were matched to each case based on age, gender, primary discharge diagnosis, and time hospitalized (within same quarter). MEASUREMENTS: Standardized coding of medical record information, including demographic characteristics, clinical information, intubation and mechanical ventilation characteristics, medications, and selected laboratory indexes. RESULTS: As compared to the control subjects, patients who self-extubated were more likely to be medical than surgical patients ($p < 0.001$) and have a current history of smoking ($p < 0.05$). Prior to the self-extubation, patients had a greater likelihood of hospital-acquired infections ($p < 0.001$) or other hospital-acquired adverse events ($p < 0.001$), abnormal (< 10, > 50 mg/dL) BUN ($p < 0.05$), and abnormal (< 20, > 50 mm Hg) P_{aCO_2} ($p < 0.05$); they also were more likely to be restless or agitated ($p < 0.001$), and more likely to be physically restrained ($p < 0.001$). A logistic regression model demonstrated that presence of restlessness or agitation and presence of a hospital-acquired adverse event were independently associated with self-extubation from mechanical ventilatory support. In examining outcomes, as compared to the control subjects, those who self-extubated had longer lengths of stay in ICU and hospital, were more likely to need reintubation, and were more likely to suffer complications from intubation. However, none of the cases died within 48 hours of self-extubation. CONCLUSION: The results underscore the need for clinical guidelines for weaning and for monitoring patients at risk of self-extubation.

American College of Chest Physicians/Society of Critical Care Medicine Consensus Conference Definitions of the Systemic Inflammatory Response Syndrome and Allied Disorders in Relation to Critically Injured Patients—Muckart DJ, Bhagwanjee S. Crit Care Med 1997; 25(11):1789.

OBJECTIVES: To determine the frequency of the proposed definitions for the systemic inflammatory response syndrome (SIRS), sepsis, and septic shock, and to further define severe SIRS and sterile shock as determined at 24 hours of admission to an intensive care unit (ICU) in critically

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ill trauma patients without head injury, and their relationships to mechanism of injury, Acute Physiology and Chronic Health Evaluation (APACHE) II score, risk of death, Injury Severity Score (ISS), number of organ failures, and mortality rate. DESIGN: Prospective, inception cohort analysis. SETTING: Sixteen-bed surgical ICU in a teaching hospital. PATIENTS: Four hundred fifty critically injured patients without associated head trauma. Penetrating trauma accounted for 70% (gunshot 202; stab 113) and nonpenetrating trauma for 30% (motor vehicle collision 103; blunt 32) of admissions. Three hundred ninety-four (88%) patients underwent surgical procedures. INTERVENTIONS: None. MEASUREMENTS & RESULTS: Infective and noninfective insults were distinguished by the need for therapeutic or prophylactic antibiotics, respectively, based on an established antibiotic policy. Three hundred ninety-five (87.8%) patients fulfilled a definition of the SIRS criteria. The frequency of the definitive categories was SIRS 21.8%, sepsis 14.4%, severe SIRS 8.4%, severe sepsis 13.6%, sterile shock 9.3%, and septic shock 20.2%. Patients with penetrating trauma had a significantly higher frequency of sepsis, severe sepsis, and septic shock ($p < 0.01$). The APACHE II score, risk of death, and number of organ failures increased significantly in both infective and noninfective groups with increasing severity of the inflammatory response. Sterile shock was associated with a significantly higher APACHE II score ($p < 0.02$), risk of death ($p < 0.01$), and number of organ failures ($p = 0.03$) compared with septic shock. Only sterile shock was associated with a significantly higher ISS ($p < 0.01$). Organ system failure was significantly higher ($p < 0.001$) in nonsurvivors compared with survivors in all categories. The only significant difference ($p < 0.001$) in mortality rate was found between patients in shock and all other categories. CONCLUSIONS: The current definitions of SIRS, sepsis, and related disorders in critically injured patients without head trauma show a significant association with physiologic deterioration and increasing organ dysfunction. The only significant association with mortality, however, is the presence of shock. The definitions require refinement, with the possible inclusion of more objective gradations of organ system failure, if they are to be used for stratifying severity of illness in seriously injured patients.

Airways Obstruction in Patients with Long-Term Asthma Consistent with 'Irreversible Asthma'—Backman KS, Greenberger PA, Patterson R. Chest 1997; 112(5):1234.

OBJECTIVE: To describe a series of 8 patients with long-term asthma and pulmonary function consistent with "end-stage," irreversible obstruction. DESIGN: Retrospective descriptive analysis of patients with severe asthma. SETTING: A university-based allergy-immunology service with a large population of corticosteroid-dependent patients with asthma. PATIENTS: Eight patients with long-standing asthma and apparently irreversible airways obstruction despite long-term oral and inhaled corticosteroid therapy. MEASUREMENTS: Pulmonary function data, radiographic studies including chest radiograph and high-resolution CT (computed tomography) of the chest, and serologic analysis to rule out allergic bronchopulmonary aspergillosis and α1-antitrypsin deficiency had been performed as indicated, and these results were obtained through chart review. RESULTS: The age of the patients ranged from 41 to 58 years, with a mean duration of asthma of 39 years (SD = 12.4 years). No patient had evidence of any other pulmonary disease process. The mean duration of daily or alternate-day oral corticosteroid treatment was 15.8 years (SD = 11.8 years). Despite intensive pharmacotherapy, all patients had an FEV_1 57% (42 ± 12%) with marked small airways disease as reflected in the forced expiratory flow between 25% and 75% of the FVC. Three of the 8 patients demonstrated an accelerated decline in FEV_1 despite continuous systemic corticosteroids. CONCLUSIONS: We have described a series of 8 patients with long-standing asthma who demonstrate irre-

versible airways obstruction despite long-term systemic and inhaled corticosteroids. The term "end-stage asthma" or irreversible asthma might be applied to these patients in whom fixed obstruction has occurred in the absence of other pulmonary diseases.

How To Use Articles about Harm: The Relationship between High Tidal Volumes, Ventilating Pressures, and Ventilator-Induced Lung Injury—Meade MO, Cook DJ, Kernerman P, Bernard G. Crit Care Med 1997;25(11):1915.

BACKGROUND: Intensivists commonly encounter patients who may be inadvertently harmed by critical care interventions. This article is designed to guide clinicians in the evaluations of an individual article assessing a question of harm, as well as the sum of multiple pieces of evidence. OBJECTIVES: To assess the vaidity of a group of articles about the relationship between high tidal volumes and ventilating pressures on ventilator-induced lung injury; to interpret the results of these studies; and to consider whether they apply in practice. DATA SOURCES: Issues of harm are sometimes measured in randomized trials, but are evaluated more often in myriad observational studies. DATA EXTRACTION: We use critical appraisal guides for experimental studies (eg, randomized trials) and observational studies (eg, cohort studies, case-control studies, and case series) that evaluate the potentially harmful exposure of high tidal volumes and ventilating pressures. This involves assessing the validity of the research, then determining the strength of association between the putative harmful exposure and adverse outcomes. These study designs and their interpretation using relative risks and odds ratios are reviewed. Finally, the relevance of this information (or lack thereof) to clinical practice needs to be determined. DATA SYNTHESIS: Examining these studies individually and in totality, there appears to be a relationship between high tidal volumes and ventilating pressures, although the strength of inference from this research is limited by design issues and sample sizes. CONCLUSIONS: Critically appraising a body of literature is more challenging than evaluating a single study, but often gives a broader view of the available evidence. Future large, rigorous, randomized trials of different approaches to mechanical ventilation will help to advance our understanding and to better inform our practice.

Health-Related Quality of Life after Acute Lung Injury—Weinert CR, Gross CR, Kangas JR, Bury CL, Marinelli WA. Am J Respir Crit Care Med 1997;156(4 Pt 1):1120.

Our study objective was to assess health-related quality of life in survivors of acute lung injury (ALI) and to supplement generic and disease-specific questionnaires with findings from a focus group of ALI survivors. Six patients participated in the focus group, which revealed patient concerns with amnesia, depressed mood, avoidance behaviors, and a prolonged recovery period. Using a cross-sectional study design, 24 patients completed a questionnaire 6 to 41 months after their lung injury. A total of 43% of the patients with ALI met criteria for depression; 43% had self-reported significant functional limitations, although 39% had minimal or no limitations. Significant respiratory and psychologic symptoms were reported in one quarter to one third of patients. There were large decrements in all domains of the SF-36 (a generic health-related quality-of-life instrument) in our sample compared with norms previously established for the general population. In addition, our patients had similar physical difficulties compared with previously studied patients with chronic medical illnesses but had more deficits in the social functioning and mental health domains. We conclude that long after lung injury, survivors have significantly lower health-related quality of life than the general population and are likely to have pulmonary and psychologic symptoms.

Comparison of Simultaneously Obtained Arterial and Capillary Blood Gases in Pediatric Intensive Care Unit Patients—Harrison AM, Lynch JM, Dean JM, Witte MK. Crit Care Med 1997;25(11):1904.

OBJECTIVE: To determine whether capillary blood gas measurements provide a clinically acceptable estimate of arterial pH, P_{CO_2}, and P_{O_2}. DESIGN: Prospective convenience sample. SETTING: Pediatric intensive care unit at a referral children's hospital. PATIENTS: Fifty children > 1 month of age with indwelling arterial catheters. INTERVENTIONS: A local anesthetic was applied to the third finger of the hand contralateral to a radial artery catheter. After 90 minutes, simultaneous arterial and capillary blood gases were drawn. MEASUREMENTS & RESULTS: Arterial and capillary pH, P_{CO_2}, and P_{O_2} were measured. Heart rate and Wong/Baker faces score were noted before and during capillary blood gas collection to assess discomfort associated with blood collection. There was a strong correlation between capillary and arterial pH ($r^2 = 0.903$, $p < 0.0001$). The relative average bias of the capillary pH was 0.009, with capillary lower than arterial and 95% limits of agreement of ± 0.032. In all patients, the absolute value of the difference between arterial and capillary pH was ≤ 0.05. There was a strong correlation between arterial and capillary P_{CO_2} ($r^2 = 0.955$, $p < 0.0001$). The relative average bias of the capillary P_{CO_2} was 1.6 torr (0.21 kPa), with capillary higher than arterial and 95% limits of agreement of ± 4.5 torr (± 0.6 kPa). In 2 of 50 patients, the absolute value of the difference between arterial and capillary P_{CO_2} was > 6.5 torr (> 0.87 kPa). Despite a statistically significant correlation between capillary and arterial P_{O_2} ($r^2 = 0.358$, $p < 0.0001$), the absolute value of the difference between arterial and capillary P_{O_2} was > 6.5 torr (> 0.87 kPa) in 42 of 50 patients. Pain, endotracheal intubation, vasoactive drips, or pharmacologic paralysis did not affect accuracy of the capillary pH or P_{CO_2}. CONCLUSIONS: Capillary blood gases accurately reflect arterial pH and P_{CO_2} in most pediatric intensive care unit patients. Capillary samples did not significantly underestimate arterial hypercarbia or acidosis. This conservative reflection of metabolic status may be particularly useful in hemodynamically stable patients with mild-to-moderate lung disease.

Smoking Cessation in Hospitalized Patients. Results of a Randomized Trial—Miller NH, Smith PM, DeBusk RF, Sobel DS, Taylor. Arch Intern Med 1997;157(4):409.

BACKGROUND: Few research studies have evaluated the effectiveness of smoking interventions in hospitalized patients. This randomized controlled trial compared the efficacy of 2 smoking cessation programs in patients hospitalized in 4 community hospitals in a large health maintenance organization within the San Francisco Bay Area in California. METHODS: Patients were randomly assigned to usual care (n = 990), nurse-mediated, behaviorally oriented inpatient counseling focused on relapse prevention with 1 postdischarge telephone contact (minimal intervention, n = 473), or the same inpatient counseling with 4 postdischarge telephone contacts (intensive intervention, n = 561). The main outcome measure, smoking cessation rate, was corroborated by plasma cotinine determination or family confirmation, 1 year after enrollment. RESULTS: At 1 year smoking cessation rates were 27%, 22%, and 20% for intensive intervention, minimal intervention, and usual care groups, respectively (p = 0.009 for intensive vs usual care). Subgroup analyses by diagnosis revealed that the odds of cessation among patients with cardiovascular disease or other internal medical conditions were greater among those receiving the intensive intervention than among their counterparts receiving usual care (odds ratios, 1.6 and 2.0, respectively). CONCLUSIONS: A multicomponent smoking cessation program consisting of physician advice; in-hospital, nurse-mediated counseling; and multiple postdischarge telephone contacts was effective in increasing smoking cessation rates among hospitalized smokers. Hospital-wide smoking cessation programs could substantially increase the effectiveness of hospital smoking bans.

Measurement of Cardiac Output by Transesophageal Echocardiography in Mechanically Ventilated Patients. Comparison with Thermodilution—Estagnasie P, Djedaini K, Mier L, Coste F, Dreyfuss D. Intensive Care Med 1997; 23(7):753.

OBJECTIVE: The determination of basal cardiac output (C.O.) and of its variations during different therapeutic interventions liable to increase or de-

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crease it in mechanically ventilated patients using transesophageal echocardiography (TEE). DESIGN: To compare C.O. measurements simultaneously obtained by transmitral single-plane TEE and thermodilution. SETTING: Medical intensive care unit. PATIENTS: Twenty-two consecutive mechanically ventilated patients hospitalized for various medical conditions were included. INTERVENTIONS: The comparisons between transmitral single-plane TEE and thermodilution measurements were made at baseline and after different therapeutic interventions affecting C.O. (fluids or dobutamine infusion or positive end-expiratory pressure titration). MEASUREMENTS: Seventy-four measurements were obtained. Cardiac output using TEE was the product of the mitral valve area, the time-velocity integral of flow at the same site and the heart rate. RESULTS: A significant correlation was observed between thermodilution and TEE measurements of C.O. ($n = 74$, $r = 0.78$, $p < 0.001$) despite wide limits of agreement (mean ± 2 standard deviations = −0.3 ± 3.1 l/min). Thermodilution and TEE C.O. determinations both had significant inverse correlation with the arterial-venous oxygen content difference in ten consecutive patients ($r = 0.77$, $p < 0.01$ and $r = 0.71$, $p < 0.01$, respectively). The correlation between variations of C.O. greater than 20% obtained by thermodilution and TEE was significant ($r = 0.89$, $p < 0.001$). The operative characteristics implied the ability of TEE to predict significant variations of thermodilution C.O. (sensitivity 85% and negative predictive values 86%). Moreover, $C_{(a-v)O_2}$ changes of 5% or more were better detected using TEE than thermodilution. CONCLUSIONS: These results suggest that although transesophageal C.O. measurements cannot replace thermodilution ones, the determination of C.O. variations obtained using TEE may be useful in the management of critically ill mechanically ventilated patients. This technique may make it possible to monitor hemodynamics during initial therapeutic interventions in those patients in whom right heart catheterization cannot be performed immediately.

Cost-Effectiveness of the Clinical Practice Recommendations in the AHCPR Guideline for Smoking Cessation—Cromwell J, Bartosch WJ, Fiore MC, Hasselblad V, Baker T. JAMA 1997; 278(21):1759.

CONTEXT: The Agency for Health Care Policy and Research (AHCPR) published the Smoking Cessation: Clinical Practice Guideline in 1996. Based on the results of meta-analyses and expert opinion, the guideline identifies efficacious interventions for primary care clinicians and smoking cessation specialty providers. OBJECTIVE: To determine the cost-effectiveness of clinical recommendations in AHCPR's guideline. DESIGN: The guideline's 15 recommended smoking cessation interventions were analyzed to determine their relative cost-effectiveness. Then, using decision probabilities, the interventions were combined into a global model of the guideline's overall cost-effectiveness. PATIENTS: The analysis assumes that primary care clinicians screen all presenting adults for smoking status and advise and motivate all smokers to quit during the course of a routine office visit or hospitalization. Smoking cessation interventions are provided to 75% of U.S. smokers 18 years and older who are assumed to be willing to make a quit attempt during a year's time. INTERVENTION: Three counseling interventions for primary care clinicians and 2 counseling interventions for smoking cessation specialists were modeled with and without transdermal nicotine and nicotine gum. MAIN OUTCOME MEASURE: Cost (1995 dollars) per life-year or quality-adjusted life-year (QALY) saved, at a discount of 3%. RESULTS: The guideline would cost $6.3 billion to implement in its first year. As a result, society could expect to gain 1.7 million new quitters at an average cost of $3779/quitter, $2587/life-year saved, and $1915 for every QALY saved. Costs per QALY saved ranged from $1108 to $4542, with more intensive interventions being more cost-effective. Group intensive cessation counseling exhibited the lowest cost per QALY saved, but only 5% of smokers appear willing to undertake this type of intervention. CONCLUSIONS: Compared with other preventive inter-

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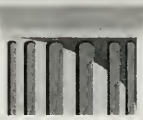

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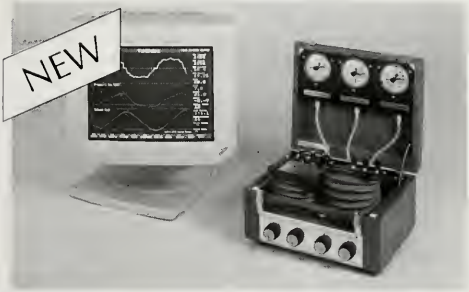

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ventions, smoking cessation is extremely cost-effective. The more intensive the intervention, the lower the cost/QALY saved, which suggests that greater spending on interventions yields more net benefit. While all these clinically delivered interventions seem a reasonable societal investment, those involving more intensive counseling and the nicotine patch as adjuvant therapy are particularly meritorious.

A Comparison of Beclomethasone, Salmeterol, and Placebo in Children with Asthma—Simons FER. N Engl J Med 1997;337(23):1659.

BACKGROUND: An inhaled glucocorticoid is currently the medication of choice for long-term control of persistent asthma in children. The role of long-acting β-2-adrenergic-receptor agonists, such as salmeterol, needs to be defined. METHODS: We conducted a randomized, double-blind, placebo-controlled, parallel-group, 1-year study of 241 children (mean [± standard deviation] age, 9.3 ± 2.4 years) with clinically stable asthma and less than 1 month of prior glucocorticoid use. We compared inhaled beclomethasone dipropionate (200 μg twice daily) with salmeterol xinafoate (50 μg twice daily) and placebo (lactose). The primary outcome measure, airway responsiveness (as assessed with a methacholine challenge), was evaluated before treatment; after 3, 6, 9, and 12 months of treatment (12 and 36 hours after study medications had been withheld); and 2 weeks after the end of treatment. Spirometry, symptoms, use of rescue medication (200 μg of albuterol inhaled as needed), and adverse effects were also assessed. RESULTS: During months 1 through 12 overall, beclomethasone was associated with significantly less airway hyperresponsiveness than salmeterol ($p = 0.003$) or placebo ($p < 0.001$). This effect was lost 2 weeks after treatment had been stopped. As compared with placebo, beclomethasone was associated with less variability between morning and evening in the peak expiratory flow ($p = 0.002$), as was salmeterol ($p = 0.02$). Beclomethasone was also associated with a reduced need for albuterol as rescue therapy ($p < 0.001$) and fewer withdrawals because of asthma exacerbations ($p = 0.03$), but salmeterol was not ($p = 0.09$ and $p = 0.55$, respectively). During months 1 through 12, linear growth was 3.96 cm in the children receiving beclomethasone, as compared with 5.40 cm in the salmeterol group ($p = 0.004$) and 5.04 cm in the placebo group ($p = 0.018$). Height was not measured after treatment ended. CONCLUSIONS: Beclomethasone was effective in reducing airway hyperresponsiveness and in controlling symptoms of asthma, but it was associated with decreased linear growth. Salmeterol was not as effective as beclomethasone in reducing airway hyperresponsiveness or in controlling symptoms; however, it was an effective bronchodilator and was not associated with rebound airway hyperresponsiveness, masking of symptoms, or adverse effects. *See the related editorial: **Choosing Therapy for Childhood Asthma**—Holgate ST, Frew AJ. N Engl J Med 1997; 337(23):1690-1692.*

Inhaled Nitric Oxide in Newborn and Paediatric Patients with Pulmonary Hypertension and Moderate to Severe Impaired Oxygenation: Effects of Doses of 3-100 Parts per Million—Lonnqvist PA. Intensive Care Med 1997; 23(7):773.

OBJECTIVE: To assess the effects of inhaled nitric oxide (INO) 3-100 ppm on oxygenation in both newborn and paediatric patients with pulmonary hypertension and impaired gas exchange. DE-

SIGN: Open, prospective, multicentre study. SETTING: Tertiary neonatal and paediatric intensive care units in university referral centres. PATIENTS: Newborn (age ≤ 7 days; n = 26) and paediatric (age 8 days-7 years; n = 16) patients with pulmonary hypertension verified by echocardiography and an oxygenation index of (OI) 15–40 were included in the study. INTERVENTIONS: The patients were subjected to stepwise increases in doses of INO (0, 3, 10, 30, 60, 100 ppm). MEASUREMENTS & RESULTS: The effect on oxygenation was measured by repeated blood gas analysis. A positive response to INO was defined as a reduction in OI of ≥ 25% compared to baseline (0 ppm). INO was found to improve oxygenation in both newborn ($p < 0.0001$) and paediatric ($p = 0.015$) patients and the response rate was 77 and 50%, respectively. A marked interindividual difference in the magnitude of the response was found between patients (change in OI compared to baseline: −90 to 15%). Only 2 of 28 responding patients required doses in excess of 30 ppm in order to show a positive response. CONCLUSIONS: INO is capable of improving oxygenation in both newborn and paediatric patients with pulmonary hypertension and impaired gas exchange, although the magnitude of the individual response can vary greatly. Doses in excess of 30 ppm are only rarely required in order to achieve a reduction in the oxygenation index of ≥ 25%.

Acute Respiratory Distress Syndrome Due to *Falciparum malaria* in a Pregnant Woman—Baud M, Bauchet E, Poilane I, Levacher S, Pourriat JL. Intensive Care Med 1997;23(7):787.

We report the case of a pregnant woman (29th week), living in a Paris suburb, about 20 miles from an international airport. She presented with septic shock and severe acute respiratory distress syndrome (ARDS). A few parasitized erythrocytes were discovered in a hemorrhagic bronchoalveolar lavage (BAL), specimen and many were found on examination of the placenta after a caesarean section had been performed. The patient's condition dramatically improved once given quinine therapy. This is an uncommon case on account of: (1) the unusual clinical course with no organ failure but ARDS, (2) the unusual way the diagnosis was made, (3) the very unusual way the patient became contaminated (airport malaria), (4) the pregnant condition of the patient.

Exogenous Surfactant and Partial Liquid Ventilation: Physiologic and Pathologic Effects—Mrozek JD, Smith KM, Bing DR, Meyers PA, Simonton SC, Connett JE, et al. Am J Respir Crit Care Med 1997;156(4 Pt 1):1058.

We compared the effects of surfactant and partial liquid ventilation (PLV), and the impact of administration order, on oxygenation, respiratory system compliance (C_{rs}), hemodynamics, and lung pathology in an animal lung injury model. We studied 4 groups: surfactant alone (S; n = 8); PLV alone (PLV-only; n = 8); surfactant followed by PLV (S-PLV; n = 8); and PLV followed by surfactant (PLV-S; n = 8). Following treatments, all animals had improved oxygenation index (OI) and C_{rs}. Animals in PLV groups showed continued improvement over 2 hours (% change OI: PLV-S −83% vs S −47%, $p < 0.05$; % change C_{rs}: S-PLV 73% vs S 13%, $p < 0.05$). We also saw administration-order effects: surfactant before PLV improved C_{rs} (0.92 mL/cm H_2O after surfactant vs 1.13 mL/cm H_2O after PLV, $p < 0.02$) without changing OI, whereas surfactant after PLV did not change C_{rs} and OI increased (5.01 after PLV vs 8.92 after surfactant, $p < 0.03$). Hemodynamics were not different between groups. Pathologic analysis demonstrated decreased lung injury in dependent lobes of all PLV-treated animals, and in all lobes of S-PLV animals, when compared with the lobes of the S animals ($p < 0.05$). We conclude that surfactant therapy in combination with PLV improved oxygenation, respiratory system mechanics, and lung pathology to a greater degree than surfactant therapy alone. Administration order affected initial physiologic response and ultimate pathology: surfactant given before PLV produced the greatest improvements in pathologic outcomes.

Impairment of Lung and Chest Wall Mechanics in Patients with Acute Respiratory Distress Syndrome: Role of Abdominal Distension—Ranieri VM, Brienza N, Santostasi S, Puntillo F, Mascia L, Vitale N, et al. Am J Respir Crit Care Med 1997;156(4 Pt 1):1082.

Recent data have suggested that the elastic properties of the chest wall (CW) may be compromised in patients with ARDS because of abdominal distension. We partitioned CW and lung (L) mechanics, assessed the role of abdominal distension, and verified whether the underlying disease responsible for ARDS affects the impairment of respiratory mechanics. Volume-pressure (V-P) curves (interrupter technique) were assessed in 9 patients with surgical ARDS and 9 patients with medical ARDS. Relative to 9 patients undergoing heart surgery, V-P curves of the respiratory system (rs) and L of patients with surgical or medical ARDS showed a rightward displacement. V-P curves of the CW and the L showed an upward concavity in patients with medical ARDS and a downward concavity in patients with surgical ARDS. Although the CW and the abdomen (abd) V-P curves in patients with medical ARDS were similar to those obtained in patients undergoing heart surgery, they showed a rightward shift and a downward flattening in patients with surgical ARDS. In 5 of these patients, a reduction in static end-inspiratory pressure of the abd (69 ± 4%), rs (30 ± 3%), CW (41 ± 2%), and L (27 ± 3%) was observed after abdominal decompression for acute bleeding. Abdominal decompression therefore caused an upward and leftward shift of the V-P curves of the respiratory system, chest wall, lung, and abdomen. In conclusion we showed that impairment of the elastic properties of the respiratory system may vary with the underlying disease responsible for ARDS. The flattening of the V-P curve at high pressures observed in some patients with ARDS may be due to an increase in chest wall elastance related to abdominal distension. These observations have implications for the assessment and ventilatory management of patients with ARDS.

Lower Respiratory Tract Colonization and Infection during Severe Acute Respiratory Distress Syndrome: Incidence and Diagnosis—Delclaux C, Roupie E, Blot F, Brochard L, Lemaire F, Brun-Buisson C. Am J Respir Crit Care Med 1997;156(4 Pt 1):1092.

Ventilator-associated pneumonia (VAP) is difficult to detect and is often unsuspected during adult respiratory distress syndrome (ARDS). We prospectively evaluated lower respiratory tract (LRT) colonization and infection in 30 patients with severe ARDS (P_{aO_2}/F_{IO_2} ratio < 150 mm Hg), using repeated quantitative cultures of plugged telescopic catheter (PTC) specimens taken blindly via the endotracheal tube every 48 to 72 hours after onset of ARDS. All patients except one were receiving antibiotics. When VAP was suspected on the presence of clinical criteria for infection, a repeated PTC and, when possible, a bronchoalveolar lavage (BAL) were obtained before any new antimicrobials were administered; samples growing ≥ 10^3 cfu/ml (PTC) or ≥ 10^4 cfu/ml (BAL) were considered diagnostic of infection. Twenty-four VAP episodes were diagnosed in 18 patients (60% of patients or 4.2/100 ventilator-days) a mean of 9.8 ± 5.7 days after onset of ARDS. Eighteen LRT colonization episodes were recorded; 16 of 24 (66%) VAP episodes were preceded (by 2 to 6 d) by LRT colonization with the same organism(s), and only 2 episodes of colonization were not followed by VAP. We conclude that although VAP is of relatively late-onset during severe ARDS, its incidence is much higher than in other conditions and can be underestimated. Lower airways colonization is consistently followed by infection with the same organisms and precedes VAP in two thirds of episodes. Repeated protected specimens taken blindly may provide a useful means to predict infection and therefore allow early antimicrobial therapy in high-risk patients with diffuse lung injury.

Scheduled Change of Antibiotic Classes: A Strategy to Decrease the Incidence of Ventilator-Associated Pneumonia—Kollef MH, Vlasnik J, Sharpless L, Pasque C, Murphy D, Fraser V. Am J Respir Crit Care Med 1997;156(4 Pt 1):1040.

The purpose of this study was to determine the impact of a scheduled change of antibiotic classes, used for the empiric treatment of suspected Gram-negative bacterial infections, on the incidence of

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ventilator-associated pneumonia and nosocomial bacteremia. Six hundred eighty patients undergoing cardiac surgery were evaluated. During a 6-month period (ie, the before-period), our traditional practice of prescribing a third generation cephalosporin (ceftazidime) for the empiric treatment of suspected Gram-negative bacterial infections was continued. This was followed by a 6-month period (ie, the after-period) during which a quinolone (ciprofloxacin) was used in place of the third-generation cephalosporin. The incidence of ventilator-associated pneumonia was significantly decreased in the after-period (n = 327) compared with the before-period (n = 353) (6.7 vs 11.6%; p = 0.028). This was primarily due to a significant reduction in the incidence of ventilator-associated pneumonia attributed to antibiotic-resistant Gram-negative bacteria (0.9 vs 4.0%; p = 0.013). Similarly, we observed a lower incidence of bacteremia attributed to antibiotic-resistant Gram-negative bacteria in the after-period compared with the before-period (0.3 vs 1.7%; p = 0.125). These data suggest that a scheduled change of antibiotic classes can reduce the incidence of ventilator-associated pneumonia attributed to antibiotic-resistant Gram-negative bacteria.

Sequential Use of Noninvasive Pressure Support Ventilation for Acute Exacerbations of COPD—Hilbert G, Gruson D, Gbikpi-Benissan G, Cardinaud JP. Intensive Care Med 1997;23 (9):955.

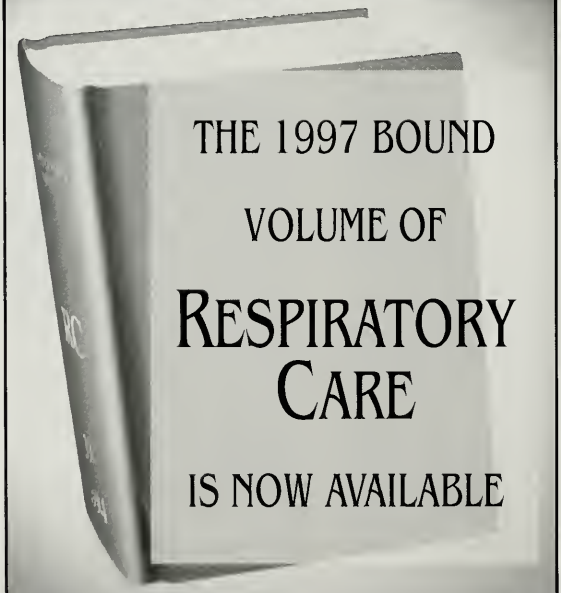
OBJECTIVES: To compare the efficacy of noninvasive pressure support ventilation (NIPSV) in acute decompensation in chronic obstructive pulmonary disease (COPD) by means of a bi-level positive airway pressure support system in a sequential mode with medical therapy alone; to assess the short-term physiologic effects of the device on gas exchange; and to compare patients successfully ventilated with NIPSV with those in whom NIPSV failed. DESIGN: A prospective case series with historically matched control study. SETTING: A general intensive care unit (ICU) of a university hospital. PATIENTS: We evaluated the efficacy of administration of NIPSV in 42 COPD patients and compared this with standard treatment in 42 matched historical control COPD patients. INTERVENTIONS: NIPSV was performed in a sequential mode, ie, bi-level positive airway pressure in the spontaneous mode was used for at least 30 min every 3 hours. Between periods of ventilation, patients could be systematically returned to bi-level positive airway pressure when the arterial oxygen saturation was < 0.85 or when the respiratory rate was > 30 breaths/min. MEASUREMENTS & RESULTS: Success rate, mortality, duration of ventilatory assistance, and length of ICU stay were recorded. Eleven of the 42 patients (26%) in the NIPSV group needed tracheal intubation compared with 30 of the 42 control patients (71%). The 31 patients in whom NIPSV was successful were ventilated for a mean of 6 ± 3 days. In-hospital mortality was not significantly different in the treated vs the control group, but the duration of ventilatory assistance (7 ± 4 days vs 15 ± 10 days, $p < 0.01$) and the length of ICU stay (9 ± 4 days vs 21 ± 12, $p < 0.01$) were both shortened by NIPSV. Bi-level positive airway pressure was effective in correcting gas exchange abnormalities. The pH values, measured after 45 min of bi-level positive airway pressure with optimal settings, in the success (7.38 ± 0.04) and failure (7.28 ± 0.04) patients were significantly different ($p < 0.05$). CONCLUSIONS: NIPSV, performed with a sequential mode, may be used in the management of patients with acute exacerbations of COPD.

Patient-Initiated, Pressure-Regulated, Volume-Controlled Ventilation Compared with Intermittent Mandatory Ventilation in Neonates: A Prospective, Randomised Study—Piotrowski A, Sobala W, Kawczynski P. Intensive Care Med 1997;23(9):975.

OBJECTIVE: To compare the effects of patient-initiated, pressure-regulated, volume-controlled ventilation (PRVC) with pressure-preset intermittent mandatory ventilation (IMV) in neonates with respiratory failure. DESIGN: Randomised, prospective study. SETTING: Intensive care unit (14 beds) in a 300-bed paediatric teaching hospital. PATIENTS: 60 neonates with respiratory distress syndrome (RDS) or congenital pneumonia, weighing < 2500 g and requiring mechanical ventilation. INTERVENTIONS: Ventilatory support until extubation via either IMV (n = 30) or PRVC (n = 27). In PRVC, the tidal volume (V_T) was preset and pressure-controlled breaths delivered with peak inspiratory pressure values adapted to achieve the preset V_T. MEASUREMENTS & RESULTS: Main outcome measures were duration of ventilation and incidence of bronchopulmonary dysplasia (BPD). Pulmonary air leaks and intraventricular haemorrhage (IVH) were considered major adverse effects. Demographic data, ventilation parameters and $P_{(a/A)O_2}$ were similar at randomisation. Duration of ventilation and incidence of BPD were not decreased by the use of PRVC. Air leaks occurred in 3 neonates in the PRVC group and in 7 babies treated with IMV (NS). The incidence of IVH grade > II was lower in babies treated with PRVC ($p < 0.05$). In a subgroup of neonates weighing < 1000 g, the duration of ventilation and incidence of hypotension were reduced in the PRVC group ($p < 0.05$). CONCLUSION: Patient-initiated, pressure-regulated, volume-controlled ventilation can be safely used in neonates and may contribute to a lower incidence of complications.

Effect of Prone and Supine Positions on Functional Residual Capacity, Oxygenation, and Respiratory Mechanics in Ventilated Infants and Children—Numa AH, Hammer J, Newth CJ. Am J Respir Crit Care Med 1997;156(4 Pt 1):1185.

Although numerous reports have described the improvement in P_{AO_2} in patients in the prone position, the underlying mechanism has yet to be determined. Some authors have suggested this phenomenon may be related to an increase in functional residual capacity (FRC); however, no previous studies have described positional changes in FRC in children with severe lung disease or in those under neuromuscular blockade. We measured arterial blood gases, FRC, R_{rs}, and C_{rs} in supine and prone positions in 30 patients under neuromuscular blockade with lung disorders including moderately severe restrictive (n = 10) and obstructive (n = 10) disease and control subjects without significant lung disease (n = 10). Prone positioning was not associated with a significant increase in FRC in the cohort of 30 patients, nor in any of the subgroups. Although individual patients demonstrated large improvements in oxygenation, a statistically significant (but clinically insignificant) increase in $P_{(a/A)O_2}$ was observed only in the subgroup of patients with obstructive disease (0.35 ± 0.03 to 0.38 ± 0.04, p = 0.027). There was no correlation between changes in FRC and changes in $P_{(a/A)O_2}$ (r = 0.225, p = 0.23). A significant improvement in R_{rs} occurred in the prone position compared to supine in patients with obstructive lung disease, decreasing from 0.264 ± 0.024 to 0.216 ± 0.021 cm H_2O/mL/s, p = 0.009. No significant changes in C_{rs} were seen in the prone position. We conclude that prone positioning has no effect on FRC and in this series of 30 patients significantly improved oxygenation only in patients with obstructive airway disease. A significant decrease in R_{rs} in patients with obstructive lung disease was also observed.



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Treatment of Nocturnal Airway Obstruction Improves Daytime Cognitive Performance in Asthmatics—Weersink EJ, van Zomeren EH, Koeter GH, Postma DS. Am J Respir Crit Care Med 1997;156(4 Pt 1):1144.

It has been shown that asthmatics have nocturnal symptoms associated with impaired cognitive performance. We explored more carefully different therapeutic approaches on this performance in relation to lung function in 46 atopics with mild to moderate asthma and with a circadian variation in peak expiratory flow (PEF) ≥ 15%. In a double-blind, parallel study they inhaled salmeterol 50 μg or fluticasone 250 μg or a combination of both twice daily for 6 weeks. The psychometric tests used informed about focused attention, mental flexibility, concentration, and attention. The results of the psychometric tests were compared with those in healthy control subjects. The PASAT score and the finishing time of the color-word chart subtest were significantly lower in these asthmatics than in the control subjects. Circadian PEF variation was the only independent factor significantly associated with impaired cognitive performance before the treatment period. The 3 treatment groups were equally effective in reducing circadian PEF variation below 10% and in improving FEV_1 and bronchial hyperresponsiveness to methacholine (MCh) both day and night. After 6 weeks of therapy, the daytime cognitive performance was improved to levels comparable to those of the healthy control subjects no matter which drug was inhaled. We conclude that a high level of circadian PEF variation (≥ 20%) has been associated with lower daytime cognitive performance in asthmatics. Reduction of circadian PEF variation to below 10% is an important goal of treatment in asthmatics.

The Effect of Deep Inspiration on Methacholine Dose-Response Curves in Normal Subjects—Moore BJ, Verburgt LM, King GG, Pare PD. Am J Respir Crit Care Med 1997;156(4 Pt 1):1278.

Normal subjects develop exaggerated airway narrowing when deep inspiration (DI) is voluntarily suppressed during methacholine challenge. Failure of periodic inflation may interfere with the bronchodilating effect of DI, and this may be fundamental to the difference in bronchodilation caused by DI in asthmatics and normal subjects. To determine whether repeated exhalations to residual volume (RV) and/or incomplete inspiration to baseline total lung capacity (TLC) could contribute to exaggerated narrowing during challenge, we tested 10 subjects on 3 separate days using modified methacholine challenge protocols. On Day 1, partial and complete flow volume curves were obtained after each dose. On Day 2, DI was prohibited, but partial curves were performed. On Day 3, DI and exhalation to RV were prohibited. TLC was measured pre- and postchallenge on each day. After comparable doses of methacholine, there was a greater change in FEV_1 on Day 2 (27 ± 15) and Day 3 (38 ± 17) than on Day 1 (14 ± 8) ($p < 0.05$). There were no differences in changes in FEV_1 and FVC between Days 2 and 3, or in TLC between all 3 days. We conclude that exaggerated airway narrowing occurs in normal subjects when DI is prohibited and that this effect is not due to repeated expiration to RV, nor due to an artifact caused by a failure to inhale to TLC.

End-Inspiratory Airway Occlusion: A Method To Assess the Pressure Developed by Inspiratory Muscles in Patients with Acute Lung Injury Undergoing Pressure Support—Foti G, Cereda M, Banfi G, Pelosi P, Fumagalli R, Pesenti A. Am J Respir Crit Care Med 1997;156(4 Pt 1): 1210.

We evaluated the end-inspiratory occlusion maneuver as a means to estimate the inspiratory effort during pressure support ventilation (PS). In 9 nonobstructed acute lung injury (ALI) patients, we applied 4 levels of PS (0, 5, 10, 15 cm H_2O) to modify the inspiratory effort. End inspiratory occlusions (2 to 3 s) were performed at the end of each experimental period by pushing the inspiratory hold button of the ventilator (Servo 900 C; Siemens, Berlin, Germany). We took the difference between the end-inspiratory occlusion plateau pressure and the airway pressure before the occlusion (PEEP + PS) as an estimate of the inspiratory effort and called it PMI ($P_{musc,index}$). From the esophageal pressure tracing we obtained a reference measurement of the pressure developed by the inspiratory muscles at end inspiration ($P_{musc,ei}$) and of the pressure-time product per breath ($P_{TP/b}$) and per minute ($P_{TP/min}$). In each patient, PMI was correlated with $P_{musc,ei}$ ($p < 0.01$) and $P_{TP/b}$ ($p < 0.01$). A PMI threshold of 6 cm H_2O detected $P_{TP/min} < 125$ cm H_2O s/min with a sensitivity of 0.89 and a specificity of 0.89. We conclude that PMI is a good estimate of the pressure developed by the inspiratory muscles in ALI patients and may be used to titrate PS level. The major advantage of PMI is that it can be obtained from the ventilator display without any additional equipment.

Chest Radiographic Findings in Patients with Tuberculosis with Recent or Remote Infection—Jones BE, Ryu R, Yang Z, Cave MD, Pogoda JM, Otaya M, et al. Am J Respir Crit Care Med 1997;156(4 Pt 1):1270.

To determine if chest radiographic findings differ in adult tuberculosis patients with recent and remote infection, we reviewed the chest radiographs of 103 patients with tuberculosis in Los Angeles and performed RFLP analyses of their *Mycobacterium tuberculosis* isolates. Patients whose isolates had identical or closely related RFLP patterns were considered a "cluster." Most patients in large clusters (> 7 patients) had tuberculosis from recent infection, whereas most unclustered patients had tuberculosis from remote infection. Mediastinal adenopathy or pleural effusions were classified as typical of recent infection, and upper lobe infiltrates, cavitation, or fibrosis were classified as characteristic of remote infection. Radiographic patterns were typical of remote infection in 62% of patients and were characteristic of recent infection in 23% of patients. The distribution of these radiographic patterns was similar in clustered and unclustered patients, both with or without human immunodeficiency virus (HIV) coinfection. However, mediastinal adenopathy and pleural effusions were significantly more common in HIV-infected patients. We conclude that: (1) chest radiographic findings in adults with tuberculosis of recent infection are similar to those in patients with remote infection; (2) the distinctive chest radiographic findings in HIV-infected patients with tuberculosis are not due to an increased frequency of recent infection.

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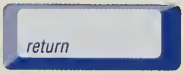
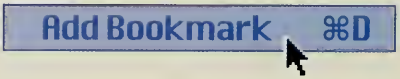
Step 4: Hit this. 

Step 5: Make a bookmark. 

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A Pediatric Asthma Clinic Pilot Program Reduces Emergency Department Visits, Hospitalizations, and Cost of Care

Teresa A Volsko BS RRT

I sought to determine whether a physician-directed medical plan integrated with self-management education could reduce emergency department (ED) visits, hospitalizations, and costs related to pediatric asthma care. METHODS: Patients entered into the clinic pilot program were 1-18 years old with a history of asthma and no documented medical treatment plan. Children with chronic pulmonary, cardiac, or neurological impairments were excluded from the study. During 3 clinic visits, a detailed assessment and plan were compiled for each child by a multidisciplinary team, consisting of a registered respiratory therapist, dietician, social worker, and nurse and directed by a pediatrician. The education plan covered early recognition of signs and symptoms, physiologic components of an acute exacerbation, trigger recognition, and a 5-step action plan for using peak flow measurements and medication. Over a 7-month period, data were collected on each subject for equal time spans prior to and after participation in the asthma clinic. Each patient served as his or her own control. Before and after clinic data were evaluated with paired *t* tests. RESULTS: Of the 27 patients, 11 were white, 11 Hispanic, and 5 black; the mean age was 8.1 years. Outcome data for ED visits were 56 before the program, 4 after; ED visits/patient were 2.1 before, 0.1 after ($p < 0.0001$). The estimated ED cost/patient was $450 before, $22 after. Before the program, 11 asthma-related hospitalizations occurred, afterwards 1. Preclinic hospitalizations/ patient were 0.4; after intervention, 0.04 ($p = 0.0095$). The estimated hospital cost/patient was $1,240; total ED and inpatient costs/patient were $1,690 prior to clinic participation. Postparticipation hospital cost/patient equaled $124; total ED and inpatient costs/patient, $146. There was a concomitant improvement in patient and family compliance with scheduled clinic visits (50% no-show before, 25% after). CONCLUSIONS: These results suggest that asthma education in an outpatient clinic setting fosters an understanding of the disease, improves adherence to medical management, and reduces use of ED services, hospitalizations, and total cost of care. Estimated total cost-savings/patient was $1,544. [Respir Care 1998;43(2):107-113]

Ms Volsko is Clinical Research Coordinator, Rainbow Pediatric Trauma Center, University Hospital Health Systems, Cleveland, Ohio. When this research was conducted, she was Coordinator NICU/Pediatrics, Respiratory Services, St Elizabeth Health Center, Youngstown, Ohio.

Ms Volsko presented a version of this paper at the annual OPEN FORUM, during the 42nd International Convention and Exhibition of the AARC in San Diego, California, November 3-6, 1996.

Correspondence: Ms Teresa A Volsko BS RRT, Clinical Research Coordinator, Rainbow Pediatric Trauma Center, University Hospital Health System, 11100 Euclid Ave, Cleveland OH 44106-6039.

Asthma is a disease of widespread socioeconomic impact, affecting approximately 3 million children each year. The cost of asthma-related health care can be attributed to the rising incidence of emergency department (ED) care and subsequent hospitalizations. The Coordinating Committee of the National Asthma Education and Prevention Program (NAEPP) estimated that the cost of emergency treatment alone exceeded $6 billion dollars in 1990.[1] Hospitalization rates for asthma increased 6% between 1980 and 1987.[2] During this period, the mortality rates rose 31%.[3]

A nationwide initiative to improve the management of asthma was undertaken by the National Heart, Lung and Blood Institute and the National Institute of Allergy and Infectious Disease in June of 1988. The national strategy focused on the role of self-management in minimizing the devastating social and economic burdens imposed by this chronic pulmonary disease.[4] In 1991, The NAEPP Report continued this quest by publishing standards of care and education guidelines for asthma disease management. Many education programs in a variety of health care settings have been developed to address the overwhelming morbidity and mortality of asthma, as well as to promote a normal healthy lifestyle for those with the disease.[5-7]

This pilot study was designed with similar goals in mind. I sought to determine whether a physician-directed medical plan integrated with self-management education could improve patient outcomes in a clinic setting. The hypothesis was that by teaching patients and their families about asthma the hospital would realize a reduction in ED visits and inpatient hospitalizations along with subsequent costs.

Methods

This prospective study is a review of 27 patients evaluated and treated in the Pediatric Asthma Clinic at St Elizabeth Health Center, Youngstown, Ohio. All patients entered into the study were clients of the Pediatric Ambulatory Care Clinic at St Elizabeth Health Center and were 1-18 years old, with a documented history of asthma. Each patient was currently receiving medical management for asthma, which was not standardized within this population prior to enrollment in the clinic. Specifically, none of these patients had a documented medical plan. This lead us to believe that they may have been at risk for emergency and inpatient treatment. Children with any other chronic pulmonary and/or cardiac problem or neurological impairments (ie, cystic fibrosis, congenital cardiac defects, or cerebral palsy) were excluded from the study group.

Education and medical management were facilitated over an average of 3 outpatient clinic visits lasting approximately 1-1.5 hours each. A multidisciplinary team approach to patient assessment and care was used with each patient encounter. The team was comprised of a board certified pediatrician, registered respiratory therapist (RRT), registered dietitian, licensed social worker, and registered nurse. All participants had demonstrated competency in the subspecialty of neonatal and pediatric care within their respective disciplines. Team members involved in the educational component were required to successfully complete a facilitator training course for instructional implementation prior to their participation in the asthma clinic.

The medical history, physical assessment, and review of prior medical management was compiled for each patient on the initial clinic visit by the pediatrician (Appendix 1). A nutritional assessment that included recommendations for weight reduction, food allergies, and meal planning was conducted by a dietitian. Peak flow maneuver, assessment of the ability to perform metered dose inhaler (MDI) actuation with a placebo (if MDIs were incorporated into previous medical management), vital signs, weight, and height were obtained by the RRT and nurse. Recommendations for psychosocial intervention were compiled following a needs assessment by the social worker. An individualized medical plan, directed by the physician, was devised from the comprehensive specialized assessments.

An education plan was created and implemented by the registered respiratory therapist to facilitate an understanding of the child's medical treatment and the role treatment played in control of acute exacerbations and maintaining wellness. Each plan incorporated 5 components: (1) recognition of asthma triggers, (2) objective monitoring through the use of a peak flow meter, (3) early warning signs of an asthma attack, (4) medication administration, and (5) breathing and relaxation techniques. Interactive games, a workbook, exercises, and videos were used to facilitate the learning process. The session content was directed by the ability of the family to comprehend and apply what was presented. The written material, including the individualized plan, was bound and utilized throughout the process. All children and families completed the required education program within 3 sessions.

Education Components

Session 1. The initial education session incorporated a review of the disease process and an introduction to the medical treatment plan. There were 3 goals established for this session. First, asthma was defined as a chronic disease process with acute exacerbations. The therapist presented the 3 events that occur with an acute exacerbation, ie, bronchospasm and constriction, excessive mucus production, and airway edema. The specific medications used in the child's medical management plan were identified and their rationale for use introduced to the family. The foundation for appropriate self-management skills, through an understanding of the disease process and the interrelationship of medical treatment, was laid.

The second goal, built on this foundation, was to empower the family and child to reduce the severity of the acute exacerbation. The respiratory therapist taught the child and the family to recognize the specific signs and symptoms that appear prior to and during an acute exacerbation. Instruction on the technique of performing a peak flow meter maneuver was given. The child and family were given a personalized calendar to document daily peak flows, medication administration, symptoms, and any associated symptom relief.

The last goal was to introduce the initial phase of the Asthma Action Plan (Appendix 2) to the patient and family. The child and family were instructed on the numeric values associated with the 3 peak flow zones (red, yellow and green) and the appropriate medication (based on the severity of symptoms the child was experiencing) to be used within each zone (Appendix 2).

Session 2. The second scheduled clinic visit focused on trigger identification and symptom control. Two goals were identified for this session. Integrating the role of trigger recognition and preventing acute asthma attacks were the first goal. The respiratory therapist assisted the child and family in trigger recognition and the tracking of those specific to the disease process. Emphasis was placed on the uniqueness of each asthmatic's pattern of trigger sensitivity and the concept of changing sensitivity patterns. The second goal was to identify therapeutic components of symptom control that complement medication administration. The integration of breathing and relaxation techniques in symptom relief was taught to the family. Instruction was directed toward proper breathing technique performance and application. There was repeated emphasis for the child to contact an adult to report the onset of acute exacerbation.

Session 3. The last session concentrated on the integration of all education components into a self-management plan. The goal of the final education visit was to foster confidence in the ability of the family and child to take responsibility for daily management of this disease process and to focus on minimizing the frequency and severity of acute exacerbations. The therapist assisted the child and family in mapping out a specific plan and identifying others, ie, teachers, school nurses, coaches, who need to know and understand the plan.

Each session was preceded by a physical examination and review of exacerbation history by the pediatrician. Medical plan adjustments were made on an as-needed basis and communication of plan changes integrated into the session. To assess session comprehension and control of symptom status, telephone contact was made to the family within 1 week of the clinic visit. Educational support during the telephone call was provided as needed. In addition, a telephone call was made the morning of the clinic visit to reconfirm appointment times. Family members were encouraged to bring the child's education booklet and medication to each visit.

Data Collection and Analysis

Demographic data, specifically age, and race were collected for each subject. Additionally, emergency room visits, number of inpatient visits, and associated emergency room and inpatient costs were collected on each child for equivalent time spans prior to and after participation in the asthma clinic. A minimum of 3 months of pre- and postclinic data collection was required. The predata collection period included the months of November-May; the postdata collection time spanned a 7-month pilot period (June-December). Collectively, the seasonal effects of asthma exacerbation were accounted for when the group data, as a whole, were evaluated. The months of data collection were relative to the child's enrollment date. Therefore, the seasonal effects on pre- and postdata collection were varied for individuals. Before and after clinic outcome data were evaluated with paired *t* tests.[8]

Results

Twenty-seven pediatric patients aged 1–18 years participated in the pilot program. The mean age was 8.1 years. Eleven (41%) of the children who participated in the pilot program were white, 11 (41%) Hispanic, and 5 (18%) black. A reduction in ED visits and hospitalizations were noted after the patient participated in the program (Table 1). Similarly, a reduction in the costs associated with ED and inpatient hospital care were also noted. There was a concomitant improvement in patient and family compliance in keeping regularly scheduled appointments (50% no-show before, 25% after).

Table 1. Outcome Variables

Variables	Before	After	p Value
Total ED* visits	56	4	—
ED visits/patient	2.1	0.1	< 0.0001
Total hospitalizations	11	1	—
Hospitalizations/patient	0.4	0.04	0.0095
Estimated ED cost/patient	$450	$22	—
Estimated hospital cost/patient	$1,240	$125	—
Total cost/patient (ED and inpatient)	$1,690	$146	—

*ED = emergency department.

Discussion

The management of asthma is a very dynamic process encompassing prompt response to acute exacerbations and control of symptoms to prevent remitting airflow limitations.[9] The NAEPP Report published in August 1991, addressed the dynamics in 4 components of asthma management. The strategies for care are comprised of objective measures of lung function and therapeutic response, pharmacologic intervention, trigger identification and environment control, and patient and family education.[10] The need to build partnerships between patients, their families, and medical professionals was emphasized in the NAEPP's 1997 *Expert Panel Report II: Guidelines for the Diagnosis and Management of Asthma.*[11] This report contends that an active partnership with patients remains the cornerstone of asthma management. This partnership combines education into every component of medical management which is tailored to patient and family needs.[11]

The pilot program for the Pediatric Asthma Clinic incorporated the 4 critical components for asthma management as outlined in the 1991 NAEPP report[10] with the philosophy for building educational partnerships advocated in the 1997 revised NAEPP *Expert Panel Report II.*[11] The components

were integrated into an individualized care plan for each patient and presented in simple formats, thereby fostering a partnership between the health care team, the child, and the family. This philosophy is not unique to our program, however. It is a common thread shared among most asthma self-management programs.[12] This partnership fostered parental commitment to asthma care—exemplified in the concomitant improvement in compliance with scheduled clinic visits compared to other scheduled clinic appointments within our sample population.

A review of the literature supports the value of a collaborative approach to the management of this complex disease process.[13-16] The expertise of several medical disciplines contributes to the development of realistic, mutually agreeable goals of management, individualized instruction, and consistent medical care. This approach lead to positive outcomes in this pilot group. The outcomes were quantified as a reduction in ED visits, inpatient hospitalizations, and the costs associated with that care. The financial analysis of the cost of care did not include the direct and indirect costs associated with increased primary physician care through the clinic, education, prescribed medications, and/or medical equipment (such as peak flow meter, spacer). Implementation of this comprehensive program was likely to increase the costs associated with improving asthma management. It was my expectation that the reduction in the costs related to emergency department and inpatient visits would exceed the costs of program implementation. If the cost-savings derived from the reduction in urgent care outweighed those associated with program implementation, the real financial value of the program would be revealed. Further long-term prospective studies are required to test these hypothesis.

In this study, each child served as his or her own control allowing for the analysis of individualized outcomes. This facilitated a mechanism for participant feedback. The child and family had a marker for their progress in the program participation. Although preliminary data of this pilot program was positive, it only encompassed a small portion of the target population for a relatively brief period of time. Data were collected for equivalent time periods in the pre- and postphases of the study. This was done to avoid biasing either the control or treatment phases. In collecting data in this fashion, however, the seasonal effects on acute exacerbations were not consistent within each subject. The pre- and postdata time period for the collective study group encompassed all 4 seasons. Pretreatment (control) data were collected from November-May, a period when asthma exacerbations are typically less frequent.[11] Data collected in the poststudy period encompassed a 7-month interval where asthma exacerbations are expected to be at their peak. Thus, the pilot study results were positive, despite my bias for a negative result. This lends merit to the findings. Failure to demonstrate individual outcomes in terms of seasonal variation is, perhaps, the major weakness of this study design. There is merit to further my investigation of this sample population, beyond the pilot phase, to include pre- and postparticipation data across the spectrum of seasonal changes.

Conclusions

These results suggest that asthma education in an outpatient clinic setting fosters an understanding of the disease process and improves adherence to medical management. The program was associated with reduced use of emergency department services, hospitalizations, and cost of care as seen by the estimated cost savings/patient of $1,544.

ACKNOWLEDGMENTS

I would like to thank Dr. Karen Codjoe and the physicians, respiratory therapists, dietitians, social workers, and nurses of the Pediatric Asthma Clinic. Without their dedication to the care of asthmatic children, neither this research nor the Clinic would be possible.

REFERENCES

1. Weiss KB, Gergen PJ, Hodgson TA. An economic evaluation of asthma in the United States. N Engl J Med 1992;326(13):862-866.
2. Kussin PS, Fulkerson WJ. The rising tide of asthma: trends in the epidemiology of morbidity and mortality from asthma. Respir Care Clin N Am 1995;1(2)163-175.
3. Data Fact Sheet. National Heart, lung and Blood Institute. May 1992.
4. Make B. Collaborative self-management strategies for patients with respiratory disease. Respir Care 1994;39(5): 566-583.
5. Klingelhofer EL, Gershwin ME. Asthma self-management programs: premises not promises. J Asthma 1988;25 (2):89-101.
6. Detwiler DA, Boston LM, Verhulst SJ. Evaluation of an educational program for asthmatic children ages 4-8 and their parents. Respir Care 1994;39(3):204-212.
7. Greineder DK, Loane KC, Parks P. Reduction in resource utilization by an asthma outreach program. Arch Pediatr Adolesc Med 1995; 149(4):415-420.
8. Glantz SA. Primer of biostatistics, 3rd edition. New York: McGraw-Hill; 1992.
9. Horwitz RJ, Busse WW. Inflammation and asthma. Clin Chest Med 1995;16(4):583-602.
10. National Asthma Education Program Expert Panel Report: guidelines for the diagnosis and management of asthma. Washington DC: NHLBI, publication number 91-3042A;1991.
11. National Asthma Education Program Expert Panel Report II: guidelines for the diagnosis and management of asthma. Washington DC: NHLBI; 1997.
12. Clark NM. Asthma self-management education: research and implications for clinical practice. Chest 1989;95(5):1110-1113.
13. Hindi-Alexander MC, Cropp GJ. Evaluation of a family asthma program. J Allergy Clin Immunol 1984;74(4, Part 1):505-510.
14. Parker SR, Mellins RB, Sogn DD. NHLBI workshop summary. Asthma education: a national strategy. Am Rev Respir Dis 1989;140 (3):848-853.
15. Beasley R, Cushley M, Holgate ST. A self management plan in the treatment of adult asthma. Thorax 1989;44(3):200-204.
16. Clark NM, Feldman CH, Evans D, Levison MJ, Wasilewski Y, Mellins RB. The impact of health education on frequency and cost of health care use by low income children with asthma. J Allergy Clin Immunol 1986;78(1, Part 1):108-115.

APPENDIX 1
St Elizabeth Health Center—Pediatric Asthma Encounter Form (obverse)

St. Elizabeth Health Center
Pediatric Asthma Encounter Form

Physician Data
Primary Physician
Referred Physician

Addressograph

Allergies

Demographics/Visits	
Date	
Age	
Sex	
Race	
Height	
Weight	
Pulse	
Respiration	
B/P	
Temperature	

Chief Complaint	
Symptom	Duration

Triggers	
Exercise	
URI	
Stress	
Allergen	
Irritant	
No Meds	
Unknown	

Medical History

Associated Symptoms	
Symptom	Duration/Characteristics
Fever	
Headache	
Rhinorrhea	
Sore throat	
Chest pain	
Vomiting	
Diarrhea	
Other	

Current Meds				
Drug	Dose	Frequency	Route	Last taken

Family History

Severity of Illness			
Symptom/Type	Occurrence		
Cough	Weekly	1-2/week	3-6/week
Wheezing			
Nocturnal Symptoms			
Activity Limitations			
Absenteeism			

Physical Examination	
General	
Eyes	
Ears	
Nose	
Throat	
Lungs	
Heart	
Abdomen	
GU	
Extremity	
Skin	
Neuro	

APPENDIX 1 (continued)
St Elizabeth Health Center—Pediatric Asthma Encounter Form (reverse)

Peak Flow Data	
Predicted	
Green Range	
Yellow Range	
Red Range	
% Predicted	

Recommendations/Referrals/Notes

APPENDIX 2
St Elizabeth Health Center—Asthma Action Plan

ASTHMA ACTION PLAN

NAME:
DATE:

Red Zone	80 - 100% of your personal best
Peak Flow Range :	
PLAN:	
Yellow Zone	50 to less than 80% of your personal best
Peak Flow Range :	
PLAN:	
Green Zone	50% or less of your personal best
Peak Flow Range :	
PLAN:	

A Review of 2,487 Mechanically Ventilated Patients: Ventilator Length of Stay (VLOS), Base Costs, ICU Distribution, and Mortality

Thomas P McCarthy RRT, Gregory Yaculak BS RRT, and Brian Ringler RRT

INTRODUCTION: For an 18-month period, 2,487 intensive care patients requiring mechanical ventilation were tracked to determine both an average ventilator length of stay (VLOS) and a base intensive care unit (ICU) cost directly related to resource consumption. METHODS: Costs were derived from the application of the Therapeutic Intervention Scoring System versus assigning hospital charges to the data. Costs were applied in relation to resource consumption over time. Data from each hospital unit were compared and a Pearson correlation coefficient was used to evaluate the data. RESULTS: Overall, the average VLOS was 68 hours. Total base costs for the 2,487 patients totaled $14.9 million. Base costs per patient ($2,114.76/day) indicated that an unnecessary continuation of mechanical ventilation for even a 12-hour period is expensive. There was a direct correlation (r = 0.99) between VLOS and cost per patient. CONCLUSIONS: Mechanical ventilation is a prime indicator of high resource consumption and cost; VLOS has a direct relationship to the cost per patient. Further investigation is necessary regarding VLOS, diagnosis, severity of illness, morbidity, and mortality of the mechanically ventilated patient population in specific ICU settings. [Respir Care 1998; 43(2):114-118]

Introduction

Many data collection systems in hospitals are focused on generating charges for accounting purposes and may not be reasonable indicators of actual resource consumption.[1] These systems may not specify a specific length of time, in hours, for mechanical ventilation of patients in each hospital unit. Accounting data, collected purely for accounting purposes, are also unable to define respective patient mixes by unit.[2] Resource consumption is a clearer indicator of actual economic cost and provides a method of measuring an incremental cost of delivering specific services to specific groups of patients.[3]

Our objective was to collect the ventilator length of stay (VLOS) data for each patient receiving mechanical ventilation in an intensive care unit (ICU) setting. Our purpose was to define average VLOS per month for each of our hospital's ICUs. Those data were then used to define a base level of ICU resource consumption that reasonably reflected a base cost for ventilated patients. Our intent was to focus on resource consumption as a cost indicator, rather than using charge (ie, patient billing) data from the hospital's accounting department.

The data also allowed us to identify the distribution of mechanically ventilated patients by unit and the distribution

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of costs directly related to resource consumption, ie, production costs. It was then possible to define an average base cost per patient by unit and to identify the most and least expensive units relative to resource consumption. Charge data, as reported from our accounting office, does not report procedures charged for on a unit by unit basis. Charges are reported per patient via the respiratory care cost center.

Mortality was also tracked to determine whether a significant mortality rate difference existed between the units we reviewed and to determine the hospitalwide mortality rate of the ventilated population.

Methods

During an 18-month period (October 1993 through March 1995), 2,487 patients were mechanically ventilated in the ICUs of the adult division of the University of Maryland Medical System. Every patient who was mechanically ventilated in the Medical ICU (MICU), Coronary Care Unit (CCU), Cardiothoracic ICU (CTICU), Surgical ICU (SICU), Oncology ICU (ONC), and Neurological/Neurosurgical ICU (Neuro) was tracked from initiation to discontinuation of mechanical ventilation.

VLOS was measured in hours for each patient. A monthly summation for each ICU was generated, defining the total number of mechanically ventilated patients and the average number of ventilator hours per patient (Total vent h/No. patients) was also generated. The Therapeutic Intervention Scoring System (TISS)[4,5] was used to evaluate the VLOS data and to determine minimal average ICU production costs incurred in treating those patients ventilated in the ICUs.

The TISS is comprised of a list of 76 therapeutic and monitoring tasks performed in ICU settings, as well as a set of relative weights. The weights are based on the relative intensity of ancillary, nursing, and physician effort used to deliver a specific service and are used to aggregate resource consumption into a single number. For instance, in the list of assigned TISS points (Table 1), 3 TISS points are assigned to assisted ventilation, and 3 TISS points are assigned to an arterial line. This does not mean that a ventilator and an arterial-line kit cost the same. The number simply represents the weighted resource consumption associated with a patient whose severity of illness requires an arterial line or assisted ventilation as a therapeutic intervention. The aggregate TISS score, then, is a reasonable measure of resource consumption and can be used to determine production and/or labor costs.[3,6-11]

A base TISS score was assigned to each patient so that the entire population could be viewed in terms of basic resource consumption associated with being mechanically ventilated. One object of this study, however, was to determine what ICU costs would be in base terms for these patients. In order to accomplish this objective, every patient who was ventilated in one of the ICUs during the time of the study needed to be included and viewed in the same base terms. The TISS applications assigned are consistently common to each of these patients and represent a reasonable and constant cost platform from which to view base cost. Therefore, for this study, higher severity of illness indicators, such as pulmonary artery catheter (4 points), central venous pressure line (2 points), antibiotic coverage (3 points), vasoactive drug infusion (4 points), chest tube (3 points), intra-aortic baloon pump (4 points), were not applied. The weighted TISS points are described in Table 1.

Table 1. Therapeutic Intervention Scoring System (TISS) for Mechanically Ventilated Patients

Procedure	TISS Weight
Intermittent mechanical ventilation or assisted ventilation	3 points
Arterial line	3 points
Tracheal suctioning	3 points
Electrocardiogram monitoring	1 point
One peripheral intravenous catheter	1 point
Standard intake & output	1 point

The monetary value assigned to a TISS point by health care economists in 1985 was $113.06.[3] By using the Consumer Price Index (CPI) data from the Bureau of Labor Statistics to adjust for annual inflation and assuming that costs increased linearly, a TISS point value of $176.24 was calculated.[12] Minimal ICU production costs per day were then calculated by multiplying the number of assigned TISS points per day by $176.24, yielding a minimal cost/day of $2,114.76.

Costs in each unit were calculated for each month by taking the total number of ventilator hours and dividing by the number of mechanically ventilated patients for an average VLOS. The following formula was then applied to that number:

First 24 hours = $2,114.76
Each subsequent 12 hours = $1,057.38

After the first 24 hours, 12-hour increments (which coincided with staff work shifts) were used to more reasonably reflect ICU staffing patterns and cost. The use of 24-hour increments would have represented 2 shifts and artificially inflated costs if a patient was assigned 24 hours of cost generation but had only been intubated for 7 additional hours following the initial 24. Therefore, if VLOS/day divided by 12 hours left more than 4 hours, a cost of $2,114.76/day was applied, because staffing and equipment for two 12-hour shifts would be committed. If VLOS/day divided by 12 hours left less than 4 hours, a cost of $1,057.38/ day was applied, because staffing and equipment use could be adjusted to reflect decreased census

and acuteness of disease. The average cost per patient was then multiplied by the number of patients to determine an average cost for mechanically ventilated patients for that month.

Mortality figures for patients receiving mechanical ventilation were also tracked. If a patient expired while receiving mechanical ventilation, that patient was counted as a mortality within the mechanically ventilated patient population. Data from each unit were compared with the Pearson correlation coefficient.

Results

Minimal ICU production costs for mechanically ventilated patients varied widely by month and by unit, as did the number of patients mechanically ventilated and the VLOS. As expected, the driving factor for cost generation was the VLOS. The overall average VLOS was 68 hours.

Total minimal costs for all units over the 18-month period were $14,913,376 with an average cost/month of $828,521. Overall, the most expensive unit was the Neuro (Fig. 1) and the least expensive unit was the ONC. However, on a per patient basis the most expensive unit was the MICU and the least expensive unit was the CTICU (Fig. 2). There was a direct correlation between VLOS and cost per patient (Figs. 2 & 3) where (r = 0.99).

CTICU accounted for 47.4% of all mechanically ventilated patients (1,181) with SICU accounting for 19.9% (495). Combined, these 2 surgical units accounted for 67.3% (1,676) of the entire mechanically ventilated population. (Fig. 4). The longest average VLOS over the 18-month period was in the MICU at 123 hours while the shortest was in the CTICU at 25.4 hours (Fig. 3). Mortality within the mechanically ventilated population, defined as any patient that expired while being mechanically ventilated, is represented in Figure 5. MICU had the highest mortality rate at 20% while CTICU had the lowest at 1%. Mortality rates for the ONC were numerically accurate but did not represent a pure oncology population because postoperative kidney transplant patients were accepted to the ONC when beds were not available in the SICU. Overall mortality for the 2,487 patients in the study population was 6%.

Discussion

Measurement of costs for ICUs has been severely limited by a lack of cost-accounting models that reflect true cost and

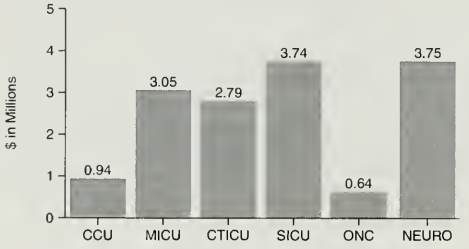

Fig. 1. Total minimal costs for all units for the 18-month period. CTICU = Cardiothoracic Intensive Care Unit (ICU); MICU = Medical ICU; CCU = Coronary Care Unit; Neuro = Neurological/Neurosurgical ICU; ONC = Oncology ICU; SICU = Surgical ICU.

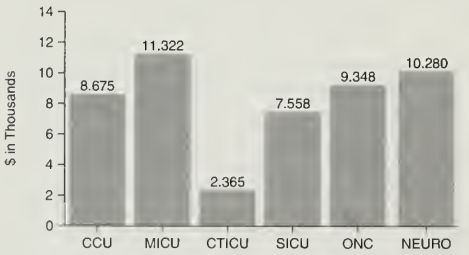

Fig. 2. Cost per patient in all units for the 18-month period. CTICU = Cardiothoracic Intensive Care Unit (ICU); MICU = Medical ICU; CCU = Coronary Care Unit; Neuro = Neurological/Neurosurgical ICU; ONC = Oncology ICU; SICU = Surgical ICU.

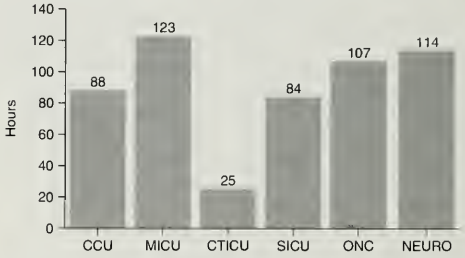

Fig. 3. The average ventilator length of stay in hours for each hospital unit. CTICU = Cardiothoracic Intensive Care Unit (ICU); MICU = Medical ICU; CCU = Coronary Care Unit; Neuro = Neurological/Neurosurgical ICU; ONC = Oncology ICU; SICU = Surgical ICU.

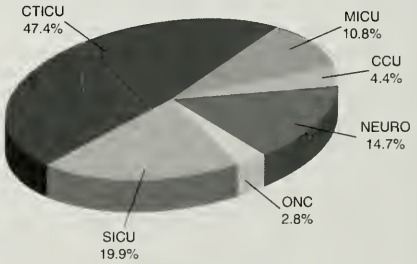

Fig. 4. The percent of mechanically ventilated patients per hospital unit. CTICU = Cardiothoracic Intensive Care Unit (ICU); MICU = Medical ICU; CCU = Coronary Care Unit; Neuro = Neurological/Neurosurgical ICU; ONC = Oncology ICU; SICU = Surgical ICU.

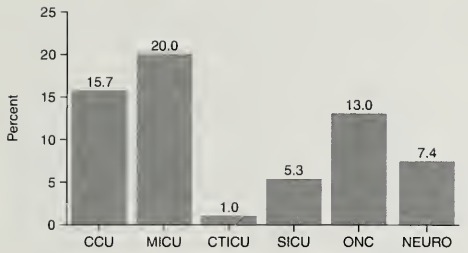

Fig. 5. Mortality within the mechanically ventilated population per unit. CTICU = Cardiothoracic Intensive Care Unit (ICU); MICU = Medical ICU; CCU = Coronary Care Unit; Neuro = Neurological/ Neurosurgical ICU; ONC = Oncology ICU; SICU = Surgical ICU.

are clinically applicable.[13] Subsequently, when we use the term 'cost' we are referring to an estimation of measured resource consumption as opposed to a reporting of hospital charge data. By defining cost in this manner we may have avoided a financial representation flaw that has led some investigators to conclude that charge data is an irrelevant surrogate for actual costs.[14]

Overall, the data identified a high level of resource consumption and a high level of cost associated with mechanically ventilated patients in ICU settings. Those costs varied per unit and per patient, indicating that resource consumption for mechanically ventilated patients is not a homogeneous cost event across all ICUs and should not be viewed as such. Costs were significant enough to suggest that VLOS should be monitored and analyzed and that strategies to decrease VLOS should be developed and implemented as part of any cost containment format.

The data did not reveal any surprising trends in comparing VLOS, cost, or mortality among the 6 units. The profile of a patient in the MICU, for instance, is usually one of a chronic disease process or of multisystem failure. It would not be surprising, then, for MICU to reflect a high VLOS, cost, and mortality rate relative to the profile and severity of illness of the patients treated on that unit. We could reasonably conclude that costs for treating these patients would be higher as the severity of illness rose, but a reasonable definition of the base costs would be needed for future investigation.

There were, however, differences among the units relative to the format under which clinicians managed the ventilators and weaned the patients. A set of therapist-driven protocols referred to as Unit Specific Policies (USP)[15] had been developed as part of a multidisciplinary approach to weaning and extubating patients in the CTICU. Prior to the development and implementation of these USP, respiratory care professionals were not responsible for ventilator management in CTICU, and the average VLOS was 72 hours. The USP were in place in CTICU for the entire scope of our study which identified an average VLOS of 25 hours. CTICU was the only unit to have USP in place during the scope of the study.

Conversely, other units in the study did not have USP for ventilator management and weaning in place, and evidence suggests that their absence may have had a negative effect on VLOS in those units. For instance, a review of extubation times in the SICU revealed that extubations were an 8 AM to 4 PM event for the most part (Fig. 6). This data would strongly indicate that the vast majority of extubations were performed only when the intensivist was present and had written orders for extubation. A review of extubation times in CTICU revealed a more uniform distribution of events and indicated that patients were extubated when they met protocol criteria (Fig. 6). One might reasonably question then, how many of the SICU patients might have been extubatable 8-12 hours earlier and what effect extubating them at an earlier time would have had on overall VLOS for SICU.

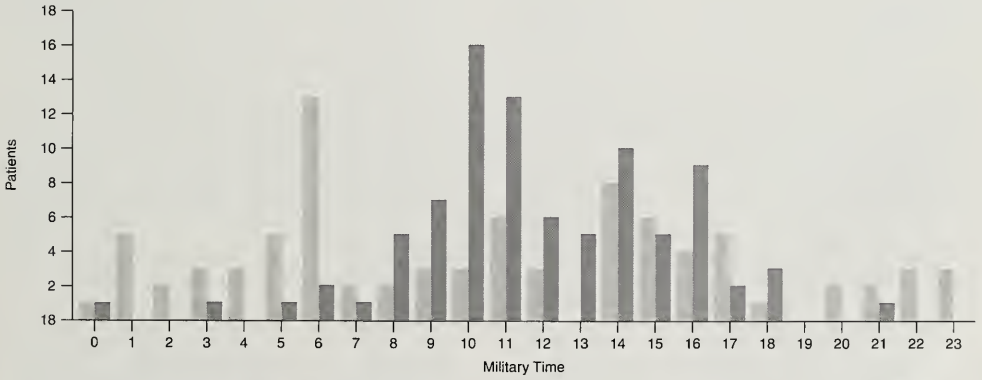

Fig. 6. Extubation times in the Surgical Intensive Care Unit (SICU) and the Cardiothoracic Intensive Care Unit (CTICU). ■ = SICU; ■ = CTICU.

The literature also suggest that the use of respiratory care protocols by qualified clinicians in the provision of patient care is a beneficial strategy relative to more appropriately allocating resources, improving outcomes, and containing costs.[16-22] 'Qualified' clinicians appear to be key for any protocol-driven strategy to be successful in decreasing VLOS and containing costs. Data also indicate that there is an inverse relationship between the experience level and staffing level of practitioners and VLOS and morbidity.[23]

The existence of such a relationship should not be surprising when one considers that there may be as many as 972 permutations for the clinician to consider when selecting a ventilator adjustment,[24] and that the likelihood of complications in either newly intubated, or previously stable, mechanically ventilated patients is high.[25,26] The strongest risk factor for acquiring a nosocomial pneumonia in an ICU setting is mechanical ventilation,[27-29] the risk for acquiring a ventilator associated pneumonia increases by 3% for each day a patient is mechanically ventilated,[30] and the Centers for Disease Control estimate that an average 5.9 day increase in hospital length of stay results from each case of nosocomial pneumonia.[31] These are important points to consider given the current wave of restructuring and reorganizing initiatives that are ongoing in health care institutions.

Most of these initiatives are consultant driven and focus on reducing salaries and benefits[32] by cutting staff and/or implementing cross-training/multiskilling initiatives. Because ICUs are high cost and labor intensive, it is reasonable to conclude that these reductions would most heavily impact critical care areas of an institution.

Our data show that mechanical ventilation is a prime indicator of high resource consumption and high cost, and that VLOS has a direct correlation with the cost per patient.

REFERENCES

1. Finkler SA. The distinction between cost and charges. Ann Intern Med 1982;96(1):102-109.
2. Birnbaum ML. Cost-containment in critical care. Crit Care Med 1986; 14(12):1068-1077.
3. Wagner DP. Economics of prolonged mechanical ventilation. Am Rev Respir Dis 1989;140(2, Part 2):S14-S18.
4. Cullen DJ, Civetta JM, Briggs BA, Ferrara LC. Therapeutic intervention scoring system: a method for quantitative comparison of patient care. Crit Care Med 1974;2(2):57-60.
5. Keene AR, Cullen DJ. Therapeutic Intervention Scoring System: update 1983. Crit Care Med 1983;11(1):1-3.
6. Malstam J, Lind L. Therapeutic Intervention Scoring System (TISS)—a method for measuring workload and calculating costs in the ICU. Acta Anesthesiol Scand 1992;36(8):758-763.
7. Rapoport J, Teres D, Lemeshow S, Avrunin JS, Haber R. Explaining variability of cost using a severity-of-illness measure for ICU patients. Med Care 1990;28(4):338-348.
8. Myles GL, Malkoff MD, Perry AG, Bucholz RD, Gomez CR. Therapeutic Intervention Scoring System used in the care of patients in pentobarbitol-induced coma to determine nurse-patient ratios. Am J Crit Care 1996; 5(1): 74-79.
9. Zimmerman JE, Wagner DP, Sun X, Knaus WA, Draper EA. Planning patient services for intermediate care units: insights based on care for intensive care unit low-risk monitor admissions. Crit Care Med 1996;24(10):1626-1632.
10. Campbell ML, Frank RR. Experience with an end-of life practice at a university hospital. Crit Care Med 1997;25(1):197-202.
11. Becker RB, Zimmerman JE, Knaus WA, Wagner DP, Seneff MG, Draper EA, Higgins TL, Estafanous FG, Loop FD. The use of APACHE III to evaluate ICU length of stay, resource use, and mortality after coronary artery by-pass surgery. J Cardiovasc Surg (Torino) 1995; 36(1):1-11.
12. Department of Labor, Bureau of Labor Statistics Data; Series ID CUUR0000SA0, 1985-1995.
13. Buist M. Intensive care resource utilization. Anaesth Intensive Care 1994;22(2):46-60.
14. Walton JR. Understanding the cost of health care with specific attention to respiratory care. Respir Care 1997;42(1):54-70.
15. McCarthy TP, Yaculak G. Organizing RC services for efficient patient care and cost containment. AARC Times 1993;17(12):46-48, 50-51.
16. Jacobs, J. How are we doing with operational restructuring and therapist-driven protocols? AARC Times 1994;18(4):66-69.
17. Cohen IL, Bari N, Strosberg MA, Weinberg PF, Wacksman RM, Millstein BH, Fein IA. Reduction of duration and cost of mechanical ventilation in an intensive care unit by use of a ventilatory management team. Crit Care Med 1991;19(10):1278-1284.
18. Wood G, MacLeod B, Moffat S. Weaning from mechanical ventilation: physician-directed vs a respiratory-therapist-directed protocol. Respir Care 1995;40(3):219-224.
19. McCarthy TP, Kircher C. The outcome-driven model: a reengineering tool for respiratory care departments. AARC Times 1994;18 (10):49-54.
20. Stoller JK. Misallocation of respiratory care services: time for a change (editorial). Respir Care 1993;38(3):263-266.
21. Shrake KL, Scaggs JE, England KR, Henkle JQ, Eagleton LE. A respiratory care assessment-treatment program: results of a retrospective study. Respir Care 1996;41(8):703-713.
22. Stoller JK, Haney D, Burkhart J, Fergus LC, Giles D, Hoisington E, et al. Physician-ordered respiratory care vs physician-ordered use of a respiratory therapy consult service: early experience at the Cleveland Clinic Foundation. Respir Care 1993;38(11):1143-1154.
23. Thorens J, Kaelin RM, Jolliet P, Chevrolet JC. Influence of the quality of nursing on the duration of weaning from mechanical ventilation in patients with chronic obstructive pulmonary disease. Crit Care Med 1995;23(11):1807-1815.
24. East TD, Morris AH. Decision support systems for management of mechanical ventilation. Respir Care 1996;41(4):327-340.
25. Keith RL, Pierson DJ. Complications of mechanical ventilation: a bedside approach. Clin Chest Med 1996;17(3):439-451.
26. Zwillich CW, Pierson DJ, Creagh CE, Sutton FD, Schatz E, Petty TL. Complications of assisted ventilation: a prospective study of 354 consecutive episodes. Am J Med 1974;57(2):161-170.
27. Celis R, Torres A, Gatell JM, Almela M, Rodriguez-Roisin R, Agusti-Vidal A. Nosocomial pneumonia: a multivariate analysis of risk and prognosis. Chest 1988;93(2):318-324.
28. Craig CP, Connelly S. Effect of intensive care unit nosocomial pneumonia on duration of stay and mortality. Am J Infect Control 1984; 12(4):233-238.
29. Cross AS, Roup B. Role of respiratory assistance devices in endemic nosocomial pneumonia. Am J Med 1981;70(3):681-685.
30. George DL. Epidemiology of nosocomial pneumonia in intensive care unit patients. Clin Chest Med 1995;16(1):29-44.
31. Public health focus: surveillance, prevention, and control of nosocomial infections. MMWR 1992;41:783-787.
32. Patterson PA. Commentary on cutting down...hospital's labor costs are top target. Aone's Leadership Prospectives 1994;2(3):11.

Books, Films, Tapes, & Software

Mosby's GenRx, 8th edition.* System requirements: CD-ROM Windows version—IBM PC or compatible, 386 or higher microprocessor, 4 MB Ram (8 MB recommended), double-speed CD-ROM drive, VGA or compatible video graphics card (256-color/8 bit recommended to view pictures), mouse, Microsoft Windows 3.1™ or higher. CD-ROM Macintosh version—68030 or higher microprocessor, 4 MB RAM (8 MB recommended), color monitor with display resolution of 640 M 480 with 256 colors, mouse, keyboard, System 7.1 or higher. 3.5 in. diskette Windows only—IBM PC or compatible, 386 or higher microprocessor, 4 MB RAM, 17 MB hard drive space, VGA, SVGA, XGA, 8514/a or compatible video graphics card, mouse, Windows 3.1 or higher. CD-ROM format (includes **Drug Master Plus**) St Louis: Mosby, Inc; 1997. $175; subscription with quarterly updates, $350.

Drug Master Plus, Rapha Group Software Inc, 1997. System requirements: IBM PC or compatible, 386 or higher microprocessor, 4 MB RAM, 17 MB hard drive space, 1.44 MB diskette drive, VGA, SVGA, XGA, 8415/a or compatible video graphics card, mouse, Windows 3.1™ or higher (optimized for Windows 95®), available on 3.5 in. diskettes. St Louis: Mosby, Inc; 1997. Annual, $99; subscription, $150.

The expansive and ever-increasing body of knowledge that is pharmacology is precisely the type of information well suited to the benefits of electronic publication. Two software products addressing this need for drug information have been released by Mosby Inc publishers. The first is a general drug reference, **Mosby's GenRx**, available on CD-ROM or diskette; and the second is a drug interaction reference, **Drug Master Plus**, on diskette. **Mosby's GenRx** was previously titled *Physician's GenRx*. With the release of the 1998 edition, the name of the package is changed, and the **Drug Master Plus** software is incorporated.

*Available from Mosby-Year Book Inc, 11830 Westline Industrial Drive, St Louis MO 63146-3318, (800) 426-4545.

Mosby's GenRx makes apt use of the computer's abilities. The installation process was easy and problem free. The user is given the option of installing all the data files on the hard disk or using the CD-ROM when data access is needed. Access time was quite short from the CD-ROM. However, an 8-speed CD-ROM drive was used for the evaluation and access time would be longer with a slower CD-ROM drive. While a CD-ROM is the logical distribution choice, an Internet-based information service might be more appropriate when one considers that the rapid pace of new pharmacologic information rivals the notoriously short market life of computer products and innovations.

The software package provides 10 major categories with which to approach drug information, including an Introduction. These categories include Drug Names, Keywords, Pharmacologic Class, Therapeutic Class, Indications for Use, Suppliers Profiles, Imprint Index, an Appendix, and the Interaction Tool. For the user seeking information on a specific drug, the category of Drug Names is probably the most helpful. By typing in the name, or scrolling through an alphabetized list, a drug is identified and typical pharmacologic information is accessed. For each drug name, the following choices are given: Categories and Brand Names, Description, Clinical Pharmacology, Indications and Usage, Contraindications, Warnings, Precautions, Drug Interactions, Adverse Reactions, Overdosage, Dosage and Administration, Patient Information, and How Supplied. A useful feature of this category on individual Drug Names is the availability of a subcategory hierarchy. For example, under albuterol a menu of further categories appears, including a drop-down menu to allow immediate selection and switching to any of the subcategories for the drug.

While **Mosby's GenRx** is generally an intuitive, easy-to-use information resource, a few technical issues are present. First, the interaction tool does not display all drug interactions. The interaction tool is a 'hot button' that allows the user to select one or more drugs and retrieve information related to interactions for the selected drugs. When the drug tetracycline is selected, the interaction tool does not display the fact that the antibiotic tetracycline potentiates the effect of mivacurium on neuromuscular blockade. The interaction information *is* in the specific drug sections, but apparently is not sufficiently cross-referenced in the database to be found by the interaction tool. The selection of mivacurium in the Interaction Tool does show an interaction with the aminoglycoside antibiotic group, although not the tetracycline group. This can obviously result in an interaction's being missed if one does not check for interactions under the drug itself rather than through the interaction tool button. Most well-known interactions between drugs such as epinephrine and β blockers are present. However, clicking on epinephrine instead of epinephrine HCl shows no such interactions. It is a little inconvenient that use of the Interaction Tool hot button does not automatically reveal interactions associated with the drug under the category Drug Names. The drug must still be typed into the space provided, after the interaction screen appears.

In the package reviewed, there is a serious 'glitch' with the drop-down menu of categories available when Drug Names are chosen. For example, when we typed in a drug name, the drop-down menu of categories in the upper right hand corner of the screen is activated. Clicking on Categories brings up the menu, which contained an entry of Table: Antiretroviral Drugs. This category, available regardless of the drug entered, takes the user to a table of antiretroviral agents not necessarily related to the drug name entered. If the user does not select this category, but simply clicks back on the drop-down menu to close it, then one is automatically taken to the antiviral drug lamivudine.

Mosby's GenRx provides a comprehensive database of drug information and appears to be thorough. This type of database is particularly helpful for those in respiratory care, because respiratory care is a specialty sector of drug administration dealing with pulmonary medicine, and on a routine basis the clinician primarily deals with inhaled aerosol drugs. As a result, respiratory care personnel may be less familiar, on a first-hand basis, with important drug classes encountered in clinical care. For this reason, it is important to have access to additional drug classes that are often used either in pulmonary disease or critical care medicine.

The major category of Pharmacologic Class is found to be of limited use. Specifically, the list of drug classes seems incomplete. Histamine-1 antagonists and β-adrenergic agonists are not found in the listing. The more specialized class of surfactant is also missing, although currently this is a group of limited drugs. H-2 antagonists are present. The antihistamines, the benzodiazepine antagonist flumazenil, and β-adrenergic agonists are all found under the second major category of Therapeutic Class. This latter category is far more complete than the Pharmacologic Class category. It is not apparent why 'antihistamines' would be a *therapeutic* rather than a *pharmacologic* class. The user would be well advised to check both categories, or alternatively, simply use the Drug Names category for searching. One glaring error is found in browsing through the Pharmacologic Class category. Under the class, sympathomimetic, ipratropium bromide is listed, along with the usual adrenergic agonists, such as isoproterenol or terbutaline. Nonetheless, the Pharmacologic Class and the Therapeutic Class categories contain listings of numerous drug groups that may prove helpful if the user is trying to identify individual drugs of a certain pharmacologic group.

The major category, Indications for Use, provides another helpful approach to identifying drugs with a common grouping. This category includes subcategories of 'airway obstruction,' which include most of the inhaled aerosol drugs in respiratory care. All of the orally inhaled corticosteroids, such as flunisolide and the new agent budesonide, are present. Fluticasone is included, but the orally inhaled metered-dose-inhaler formulation (Flovent™) released in 1996 is missing, indicating some need to update this agent. The new leukotriene antagonist, zafirlukast (Accolate™), is found, but not the 5-lipoxygenase inhibitor, zileuton (Zyflo™). The category of bronchospasm is similar in its drug listings to airway obstruction. It is interesting that both categories (airway obstruction, bronchospasm) include pork insulin, perhaps indicating a previously unknown use for this diabetic agent.

Several other major categories offer interesting and useful information. Supplier Profiles gives addresses, telephone and facsimile (FAX) numbers, and other data on drug companies, such as 3M Pharmaceuticals. The category, Imprint Index, gives actual pictures of drug formulations, similar to the color plates included in the *Physicians' Desk Reference*. However, no aerosol formulations, such as metered dose inhalers or nebulizer solutions, are seen. Finally, the Appendix category contains a list of discontinued drug products, Drug Enforcement Agency schedules of controlled substances, poison control sources, and U. S. Food and Drug Administration pregnancy categories for drugs.

In addition to a comprehensive source for drugs currently available in the U.S., the database appears to be complete and accurate with regard to drugs used in respiratory care, and, specifically, inhaled aerosol agents. For example, information on dornase alfa (Pulmozyme™) is quite complete, including use of approved nebulizing systems. A minor omission is the lack of prescribing direction for ipratropium bromide by MDI. Only the nebulizer solution is described under Dosage and Administration. However, both MDI and nebulizer formulations are listed under the How Supplied subcategory for the drug. Respiratory care drugs given by systemic administration, such as theophylline or α-1-proteinase inhibitor, are well reviewed. The software package provides thorough information for the exogenous surfactant, such as beractant.

Drug Master Plus, which is now contained as a part of **Mosby's GenRx,** is more specialized in comparison with the general drug reference. This software package deals solely with drug interactions. Comments on the content of **Drug Master Plus** apply to the same material that is now incorporated in **Mosby's GenRx.** Its installation is easy, but it does not give any indication that its installation process has finished. It simply displays the newly created program window. This may be worrisome for some users because the absence of a confirmation of installation completion usually means that something went wrong in the installation process.

Drug Master Plus offers 2 methods of tracking drug interactions. A one time drug interaction check can be made by selecting or searching for the drugs in question from an alphabetized list. Drug-to-drug, diet-to-drug, and laboratory-to-drug interactions may be reviewed. Alternatively, individual patient files may be set up and archived. In addition to patient name, identification number, address, and telephone number, a running list of drugs the patient is taking may be maintained. This allows the clinician to assess the presence or absence of interactions as the drug regimen is adjusted.

No major software flaws are noted. The search function could be more intuitively obvious to the user. To search, the user simply begins typing the name of the drug to be found. There is no 'text box' or 'blinking cursor' to cue the user and indicate that this is the case. The typed text appears at the bottom of the alphabetized drug list. The accompanying product documentation *does* instruct the user on the procedure for searching, however. This recalls the time-honored computer axiom, "When all else fails, read the manual."

Respiratory care practitioners will find this database helpful to check on drug-drug or drug-food interactions, or changes in laboratory values due to a drug. The list of drugs provided is complete and includes all of the traditional respiratory care agents, with the exception of recently released respiratory care drugs, such as zafirlukast, zileuton or orally inhaled fluticasone (Flovent™). The intranasal formulation of fluticasone propionate is listed, however.

The respiratory care practitioner will find information on interactions for drugs commonly encountered in pulmonary medicine, including H-2 receptor blocking agents (eg, ranitidine), sedating agents such as barbiturates and benzodiazepines, and neuromuscular-blocking agents. In particular, the central nervous depressant effects are well noted for the sedative-tranquilizer groups, including the histamine H-1 blockers such as benadryl. Information on the neuromuscular blocking agents such as vecuronium or succinylcholine was found to include the potentiating interaction with the polypeptide antibiotics, an effect of significance for management of paralyzed ventilator patients. Some of the clinically significant side effects of drugs are found in the drug-diet interactions, which in effect gives drug-to-body interactions. For example midazolam (Versed™) contains a cautionary note concerning its depressant effect on the central nervous system in the drug-diet interaction selection. This provides a convenient method of checking on adverse effects with any given drug.

The software is less helpful for respiratory care agents administered as an inhaled aerosol, whether orally inhaled or intranasally, than for the numerous drugs given systemically. For example, the inhaled corticosteroid, beclomethasone dipropionate, may interact with the antimicrobial rifampin. Rifampin can induce hepatic microsomal enzymes that will increase metabolism of

the steroid and reduce its systemic effects. Orally inhaled beclomethasone is intended for a topical effect in the airway and this would not be affected by microsomal enzyme induction in the liver. Certainly, enzyme induction can reduce the level of exposure in the body from the steroid absorbed by swallowing or through the lung, a beneficial side effect in this case. Without an adequate background in the pharmacokinetics of inhaled aerosol drugs, a clinician may misinterpret this drug interaction effect and consider increasing the dose of inhaled beclomethasone needlessly. Similarly, the well-known incompatibility between acetylcysteine and certain antibiotics, eg, ampicillin, if mixed in solution, is not noted in the drug-drug interactions. General and common side effects, such as stomatitis or nausea, are listed in the drug-diet section. Another omission of note is the lack of effect of the adrenergic agents such as albuterol on potassium levels in the drug-laboratory interactions for β agonists.

It is for information on drugs outside the inhaled aerosol agents that **Drug Master Plus** will be of greatest benefit for the respiratory care professional. Drug interactions are of less concern and are clinically less significant on the whole between inhaled topical aerosols and systemically administered drugs. Specifically the interactions noted between adrenergic or corticosteroid groups and other drugs are less likely with inhaled β agonists or inhaled corticosteroids, where the action and desired effect are at the site of local drug deposition. This is not to say that side effects (drug-body interactions) are not significant or important, but that drug-drug interactions between an aerosol agent and a systemic drug are less common. One important exception would be the effect of a systemically administered β blocker such as propranolol, nadolol or timolol in inhibiting or reversing the desired bronchodilating effect of an inhaled β-2 agonist. While the antagonistic effect of β blockers on epinephrine is listed, a possible antagonism of other adrenergic bronchodilators is not given. A database such as this can be more useful for seeking information on drugs that are less well known than those the practitioner usually administers to patients. This can include the cardiovascular agents, as well as the huge variety of central nervous system depressants (sedatives, tranquilizers, analgesics).

In summary, both of these computerized databases on drugs make good use of one of the most beneficial features of personal computers: relatively easy access to a large amount of detailed information that is of practical importance in "doing no harm" to patients. For the practitioner (either clinician or faculty) with the computer capability to support the software and the need to search out drug information on a frequent basis, these 2 programs offer a useful information resource.

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Letters

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Mouth-to-Mouth Ventilation during Bystander CPR

The reappraisal of the literature on mouth-to-mouth ventilation during bystander-initiated cardiopulmonary resuscitation (CPR) by a working group of the basic life support (BLS) and pediatric life support subcommittees of the American Heart Association (AHA)[1] is misleading and incomplete. There is no convincing evidence that the low incidence of initiation of CPR out-of-hospital by lay bystanders is the result of fear of becoming infected by mouth-to-mouth ventilation. Such fear should not be promoted. If such fear exists, however, it should be mitigated by explaining that initiating CPR is safe and by carrying a pocket-size barrier for ventilation of strangers. The errors in this article[1] concerning behavioral, educational, epidemiologic, and logistics issues will be summarized in a separate letter by Brasfow and Brennan.[2]

Although the article[1] says "... it is not intended to change any current AHA recommendations ...," its publication has created confusion and the erroneous impression for laypersons and the media, that in sudden coma, bystanders will save lives by merely pushing on the sternum (Step C, circulation support). In cardiac arrest, *oxygenated* blood must be circulated to restore heart beat and to keep the brain viable, requiring "head-tilt plus blowing plus pumping." The article suggests that mouth-to-mouth ventilation can be omitted in various forms of sudden loss of consciousness.[1] Laypersons cannot differentiate between various forms of sudden coma and between the absence versus presence of a weak pulse. Coma always results in upper airway obstruction if the neck is flexed,[3-12] as experienced by anesthesiologists every day. There are 20 million general anesthesias given in the U.S. each year. The data in the article's Figure 11 are misleading because Gordon's measurements of 1950[13] were made via tracheal tubes.

The omission of life-saving Step A (upper airway control by backward tilt of the head[8]), and Step B (breathing support by mouth-to-mouth[9,12]) will harm not only victims of sudden cardiac death, but also those of trauma (particularly head trauma with impact apnea), intoxication, asphyxiation (common in children), and other causes of sudden coma with or without pulselessness. Indeed, Step A was not even suggested by the authors[1] during sternal compressions *alone;* at least the shoulders should be elevated so the head assumes spontaneously a backward-tilt position, which might support a patent hypopharyngeal air passage.[3,4] If there is still a faint pulse, Steps A and B alone can often reverse the dying process. Even in cases of out-of-hospital sudden ventricular fibrillation, reoxygenation should precede counter shocks, which will not result in heart beat after more than 2-3 minutes of untreated ventricular fibrillation.[14]

This article's "historical rationale" includes errors and omissions.[1] For comatose humans *with* pulse and a natural air passage, the failure of chest-pressure methods to ventilate was documented in 1957.[4] For humans both with or without pulse, the need to combine Steps A, B, and C was documented in 1960:[3] in 30 anesthetized and curarized adult patients *and* in 12 patients with cardiac arrest, ventilation produced by sternal compressions (Step C) *alone* was measured, with or without backward tilt of the head and with or without tracheal tube. In all 30 supine, horizontal, curarized patients, the unsupported head assumed a semi-flexed position that resulted in zero tidal volumes by sternal compressions. With backward tilt of the head by elevation of the shoulders (a measure ignored in the AHA article), tidal volumes were zero in 16 and only 25-200 mL in 14 patients.[3] In all 12 patients *with* cardiac arrest, in spite of tracheal tube in place, forceful sternal compressions alone essentially moved no ventilation.[3] The authors listed this article[3] but might not have studied these only data published so far on ventilation produced by sternal compressions alone *in humans,*[3] because that paper predates citations in MEDLINE. If chest pressure alone ventilates via an open airway, it would be with unpredictably inadequate tidal volumes below resting lung volume, which causes lung collapse, particularly in terminal patients with congested lungs. Hence, not elastic recoil of the chest but rather positive pressure inflations are needed to ventilate and oxygenate.

In discussing ventilation requirements, we agree with the AHA article that low minute ventilation is sufficient to normalize arterial P_{O_2} and P_{CO_2} during the low blood flow produced by external CPR in patients with sudden cardiac arrest. However, reoxygenation in asphyxiation[11] and ventilation after restoration of spontaneous circulation, both with high blood flow, require *hyper*-ventilation, which is possible even with exhaled air.[9,11,12] Also, the authors' concern about gastric insufflation by mouth-to-mouth ventilation[1] is exaggerated. Regurgitation can also occur with sternal compressions alone, and gastric insufflation during mouth-to-mouth ventilation is self-limiting.[11] Furthermore, the presently recommended ventilation-compression ratios of 2:15 or 1:5, which is a compromise, was based on a study in dogs[15] and was not quoted.

Animal data of ventilation by chest compressions *alone,* the main argument presented for the reappraisal,[1] have no clinical relevance. Rats, pigs, and dogs have straight airways that do not obstruct, even in the absence of a tracheal tube. Humans have kinked airways that always obstruct in the absence of backward tilt of the head in coma.[3-12] Also, animals' thoraces are more compliant and have greater elastic recoil. Furthermore, the authors' admission that after 6 minutes ventilation *is* needed[1] is a concern, because paramedics' response times are usually longer than that.

In sudden ventricular-fibrillation cardiac arrest with healthy lungs, arterial oxygen levels indeed remain near normal during a long period of no blood flow without CPR.[16] This occurrence does not obviate the need for mouth-to-mouth ventilation because sternal compressions alone in the presence of complete airway obstruction recirculate venous blood and cause arterial deoxygenation in less than 60 seconds.[16]

Clinical studies by the CPCR registry of Belgium[17,18] have been overinterpreted. The fact that 10% of prehospital cardiac arrest patients survived among those who were found on arrival of the ambulance with bystanders doing *only* chest compressions, does not prove that mouth-to-mouth ventilation is not needed; it may have been used earlier, or was not necessary because of short arrest

times with continued breathing (gasping). Moreover, the efficacy of individual resuscitation measures must be determined by physiologic measurements in humans, rather than clinical, epidemiologic, statistically-significant-outcome correlations that do not prove cause-effect relationships on mechanisms.

What and how to teach the public must be extremely simple with only *one* sequence of steps, ie, A-B-C. We agree with the authors' first recommendation[1] that CPR guidelines should not be changed at this time. Their second recommendation,[1] to re-study details of mouth-to-mouth ventilation is laudable but has low priority. Higher priority should be given to promoting the motivation and skill acquisition of the public with use of media and self-training systems; to early automatic external defibrillation by first responders; and to clinical documentation of cerebral resuscitation with mild hypothermia and blood pressure support. We strongly disagree with the authors' third recommendation,[1] "...clinical trials of chest compressions *without* mouth-to-mouth ventilation are ethical...," for the obvious reason that randomly withholding ventilation and thereby condoning the moving of deoxygenated blood would be irresponsible.

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REFERENCES

1. Becker LB, Berg RA, Pepe PE, Idris AH, Aufderheide TP, Barnes TE, et al. A reappraisal of mouth-to-mouth ventilation during bystander-initiated cardiopulmonary resuscitation. Respir Care 1997;42(9):895-906. [Circulation 1997;96:2102-2112.]
2. Braslow A, Brennan RT. Reluctance of bystanders to perform mouth-to-mouth ventilation (letter). Respir Care 1998;43 (2):124-126.
3. Safar P, Brown TC, Holtey WH, Wilder R. Ventilation and circulation with close chest cardiac massage in man. JAMA 1961;176:574-576.
4. Safar P. The failure of manual artificial respiration. J Appl Physiol 1959;4:84-88.
5. Elam JO, Greene DG, Schneider MA, Ruben HM, Gordon AS, Hustead RF, et al. Head-tilt method of oral resuscitation. JAMA 1960;172:812-815.
6. Morikawa S, Safar P, DeCarlo J. Influence of head position upon upper airway patency. Anesthesiology 1961;22:265-270.
7. Ruben H, Elam JO, Ruben AM, Greene DG. Investigation of upper airway problems in resuscitation. Anesthesiology 1961; 22:271-279.
8.* Safar P, Escarraga LA, Chang F. Upper airway obstruction in the unconscious patient. Appl Physiol 1959;14:760-764.
9.* Elam JO, Brown ES, Elder JJD. Artificial respiration by mouth-to-mask method: a study of the respiratory gas exchange of paralyzed patient ventilated by operator's expired air. N Engl J Med 1954; 250:749-754.
10.* Guildner CW. Resuscitation—opening the airway: a comparative study of techniques for opening the airway obstructed by the tongue. J Am Coll Emerg Phys 1976;5: 588-590.
11.* Safar P. Ventilatory efficacy of mouth to mouth artificial respiration: airway obstruction during manual and mouth to mouth artificial respiration. JAMA 1958;167: 335-341.
12.* Safar P Escarraga LA, Elam JO. Comparison of mouth-to-airway methods of artificial respiration with the chest-pressure arm-lift methods. N Engl J Med 1958;258: 671-677.
13.* Gordon A, Fainer D, Ivy A. Artificial respiration: a new method and a comparative study of different methods in adults. JAMA 1950;144:1455-1464.
14.* Kouwenhoven WB, Jude JR, Knickerbocker GG. Closed-chest cardiac massage. JAMA 1960;173:94-97.
15. Harris CS, Kirimli B, Safar P. Ventilation-cardiac compression rates and ratios in cardiopulmonary resuscitation. Anesthesiology 1967;28:806-813.
16. Lesser R, Bircher N, Safar P, Stezoski W. Sternal compression before ventilation in cardiopulmonary resuscitation. Prehospital Disaster Med 1985;1(Suppl 1):239-241.
17.* Van Hoeyweghen RJ, Bossaert LL, Mullie A, Calle P, Martens P, Buylaert WA, Delooz H, Belgian Cerebral Resuscitation Study Group. Quality and efficiency of bystander CPR. Resuscitation 1993; 26:47-52.
18.* Bossaert L, Vanhoeyweghen R, Cerebral Resuscitation Study Group. Bystanders cardiopulmonary resuscitation (CPR) in out-of-hospital cardiac arrest. Resuscitation 1989;17(Suppl):S55-S69.

*Indicates that the reference was originally cited in the article Becker LB, Berg RA, Pepe PE, Idris AH, Aufderheide TP, Barnes TE, et al. A reappraisal of mouth-to-mouth ventilation during bystander-initiated cardiopulmonary resuscitation. Respir Care 1997;42(9): 895-906. They are renumbered and listed here for the convenience of the reader.

The authors respond:

We appreciate the thoughtful comments from Dr Safar regarding the role of mouth-to-mouth ventilation in adult CPR. The world will remain forever in the debt of James Elam MD who rediscovered the value of mouth-to-mouth ventilation in the 1950s and Dr Safar who meticulously documented the superiority of expired air ventilation to maintain blood oxygen levels. The combination of the Safar-Elam techniques[1-3] with the chest compression rediscovered by Kouwenhoven, Jude, and Knickerbocker[4] ushered in the modern era of CPR in the 1960's and has saved literally thousands of lives.

In the 1990s, however, a number of questions have arisen about cardiopulmonary resuscitation (CPR): Why is CPR so difficult for lay people to learn and remember? Why is CPR started on such a small percentage of witnessed cardiac arrests? Is poorly performed CPR perhaps capable of doing harm? Are there different causes of cardiac arrest that merit modifications of the traditional "pump and blow" of basic CPR?

Our Ventilation Working Group started its work with open minds. For this report we decided to address the particular CPR feature of mouth-to-mouth ventilation. This focus was because of indirect evidence suggesting that the disagreeable features of mouth-to-mouth ventilation, combined with a growing fear of disease transmission, were making people reluctant to start CPR. Adding mouth-to-mouth ventilation to the task of chest compression may create a complex psychomotor skill that is simply too difficult for lay rescuers to remember at the time of an event as dramatic as sudden cardiac arrest.

We decided to review the entire body of research regarding chest compression and ventilation in CPR. We noted a scarcity of human research on this topic, and think there are areas that merit further investigation. The purpose of the paper was to stimulate interest and promote CPR research. We reached the following conclusions:

- Two-person CPR with chest compression and mouth-to-mouth ventilation, performed by experienced professionals, is indisputably the most effective method to maintain brain and heart viability and to prolong ventricular fibrillation during cardiac arrest.

- Single-person CPR with chest compression and mouth-to-mouth ventilation, performed by inexperienced lay people, is probably less effective, but should be taught without reservation in all American Heart Association (AHA) CPR courses.

- We completely reject the hypothesis that mouth-to-mouth ventilation should be eliminated from CPR training. This conclusion is a distortion of our work and is without valid scientific support.

- Single-person CPR with chest compression, but without mouth-to-mouth ventilation is sub-optimal and is not recommended by the AHA. However, the optimal single-rescuer technique for lay-rescuers is not known because it must 'optimize' both the (1) physiology of promoting oxygenated blood flow as well as (2) promote maximal community-wide implementation (which may be affected by ease of training, skill retention, willingness to act, and ability). Animal studies[5] suggest that mouth-to-mouth plus chest compression improves oxygen saturation. But as the single rescuer switches from compressions to ventilation fewer compression are performed—which may adversely impact circulation of blood and myocardial perfusion. Additional knowledge on these competing processes seem important and have not yet been well studied.

- Human data on lay single-rescuer CPR without mouth-to-mouth ventilation is scant. The data from the Belgian CPR registry[6,7] and reports from the Netherlands fail to find any disadvantage for patients who received compression but not mouth-to-mouth ventilation. Moreover, our BLS instructors need practical guidance when confronted with a CPR learner they are certain will not perform mouth-to-mouth ventilation in an emergency. In such situations, the CPR learner must be encouraged to "at least do something." There is good evidence that chest compression alone is far better than no rescue attempts at all.

- We found a theme in the research regarding adults who collapse with sudden fibrillation and well-oxygenated blood. These individuals comprise a significant proportion of adult out-of-hospital arrests and may maintain acceptable blood oxygen levels for a few minutes after collapse with chest compression alone. We could hypothesize that mouth-to-mouth ventilation could be delayed for these patients for a few minutes. This window of time, however, is limited and ventilation will eventually be required. These data suggest an avenue for future research. We encourage creative research on this hypothesis; it is ethical if properly designed.

- Further research is needed to improve community CPR rates. We cannot expect lay rescuers to make judgments about the cause of collapse, nor switch from one rescue sequence to another based on the passage of time. For successful community CPR, the techniques must be easy to learn, remember, and perform during a crisis. We have called for more research because we agree that our current data does not provide complete answers to some important questions. We believe that the public is best served by conducting research to answer unresolved issues.

- Finally, readers should not mistake 'confusion' with legitimate controversy. The reason letters with divergent viewpoints are printed reflects the fact that scientific controversy still exists. In our deliberations, we adhere to the principles of evidence-based decision-making. CPR has been advocated for nearly 40 years, yet most victims of cardiac arrest never receive CPR efforts and survival rates are poor. These controversies have existed for too long without resolution. Let us resolve to perform the research to turn scientific controversy into consensus among scientists. This duty falls to all of us as guardians of public health and safety.

The Safar Resuscitation Research Center has been a beacon of quality research on the topic of CPR. We appreciate their comments and their interest in this topic. We are sure they join with us in encouraging more research evaluation in this rich and dynamic area of resuscitation.

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REFERENCES

1. Elam JO, Brown ES, Elder JJD. Artificial respiration by mouth-to-mask method: a study of the respiratory gas exchange of paralyzed patient ventilated by operator's expired air. N Engl J Med 1954; 250:749-754.
2. Safar P. Ventilatory efficacy of mouth to mouth artificial respiration: airway obstruction during manual and mouth to mouth artificial respiration. JAMA 1958; 167:33-341.
3. Safar P, Escarraga LA, Elam JO. Comparison of mouth-to-mouth and mouth-to-airway methods of artificial respiration with the chest-pressure arm-lift methods. N Engl J Med 1958;258:671-677.
4. Kouwenhoven WB, Jude JR, Knickerbocker GG. Closed-chest cardiac massage. JAMA 1960;173:94-97.
5. Idris AH, Staples ED, O'Brien DJ, Melker RJ, Rush WJ, Del Duca KD, Falk JL. Effect of ventilation on acid-base balance and oxygenation in low blood-flow states. Crit Care Med 1994;22:1827-1834.
6. Van Hoeyweghen RJ, Bossaert LL, Mullie A, Calle P, Martens P, Buylaert WA, Delooz H, Belgian Cerebral Resuscitation Study Group. Quality and efficiency of bystander CPR. Resuscitation. 1993;26:47-52.
7. Bossaert L, Vanhoeyweghen R, Cerebral Resuscitation Study Group. Bystanders cardiopulmonary resuscitation (CPR) in out-of-hospital cardiac arrest. Resuscitation. 1989;17(Suppl):S55-S69.

Reluctance of Bystanders to Perform Mouth-to-Mouth Ventilation

The Special Report, "A Reappraisal of Mouth-to-Mouth Ventilation During Bystander Initiated Cardiopulmonary Resuscitation," published in RESPIRATORY CARE,[1] and also published in *Annals of Emergency Medicine, Resuscitation, and Circulation,* fosters the unwarranted inference that laypersons are not performing cardiopulmonary resuscitaiton (CPR) because of concerns about performing mouth-to-mouth resuscitation. The evidence for this inference is

drawn primarily from samples of health care professionals who express concerns about disease transmission. Based on this faulty conclusion, the authors explore physiological issues related to exclusion of mouth-to-mouth as a CPR component skill.[2] The appearance of this Special Report has done more harm than good to efforts to train laypersons in CPR and encourage them to initiate resuscitation. The media, fueled by the Special Report's misleading title, have created dangerous false impressions in the mind of the public, such as the notion that CPR without ventilations is beneficial and that the risk of disease transmission by mouth-to-mouth contact is substantial. Because the Special Report ignores most existing research pertaining to the failure of CPR by lay bystanders to become widespread, it fails to set a useful agenda for further research aimed at increasing bystander-initiated resuscitation efforts.

While the authors propose an argument based on a selective reading of the research, we believe that the following well-documented facts about out-of-hospital cardiac arrest and bystander action are more explanatory of the failure of bystander CPR than the hypothesis offered in the Special Report:

1. CPR is not performed by lay bystanders primarily because most lay bystanders are not trained to perform CPR. Organized training is not targeted to those most likely to be present at the scene of a cardiac arrest. While the typical cardiac arrest victim is 64 years[3] and the family member at home is about 55 years old,[4] the average age of CPR trainees is 31, with a small minority 55 years and older. Fewer than 8% of course participants take CPR training because they live with someone at elevated risk of heart attack.[5,6] In addition, 74% or more of cardiac arrests occur in the home,[3,7-10] and less than 7% occur in public places.[11] Therefore, it is likely that the victim is not a stranger to the bystander and disease transmission is not a primary concern.

2. A layperson's decision and ability to respond to an emergency situation depends on a unique set of factors unlike those affecting medical professionals and paraprofessionals. Therefore, medical providers' legitimate concerns about disease transmission may not play a pivotal role in the decision-making process of lay bystanders. Compared with laypersons, medical providers have more training and experience, a duty to act, a different relationship to their cardiac arrest victims, and materials for the prevention of disease transmission at their disposal. Laypersons, on the other hand, have a socialized fear to avoid approaching "dead looking" things. According to the psychological research on 'helping behavior,'[12-19] factors inherent in the decision to act arise from the initial response to threatening, unfamiliar and/or complex situations. The decision to act depends upon, among other things, acknowledging that the situation exists and having confidence in one's ability to handle the emergency. In this calculus of action, an unaccustomed concern of laypersons, such as disease transmission related to mouth-to-mouth resuscitation, will be but one, most likely trivial, factor that presents itself later, after the decision to take action has been made. Helping behavior research has focused on lay response to public assault, medical emergencies, and trauma involving strangers, but research on lay response to the most common type of cardiac arrest, one striking a family member, is nearly nonexistent. In one paper[20] cited in the Special Report, laypersons were asked to react to cardiac arrest scenarios and select from hypothetical choices, which helping-behavior research suggests may not be the issues most salient to lay rescuers. Nonetheless, this research confirms that reluctance to perform mouth-to-mouth breathing on family members and friends does not afflict the majority of potential lay rescuers, and according to the only study cited in which lay bystanders were interviewed,[3] they do not hesitate in helping the victim even in the presence of disagreeable stimuli, such as vomitus, false teeth, alcohol on breath, and presence of blood. Further, bystanders do not advance concerns about human immunodeficiency virus (HIV).

Even if training were targeted to the right people, the quality of lay resuscitation efforts will most likely be insufficient to sustain life. Immediately following training, CPR trainees are not competent in performing ventilations of sufficient volume to cause chest rise and compressions of sufficient depth to cause cardiac perfusion and artificial pulse at the neck,[21-25] the basic CPR components related to positive outcome.[26-28] Because feelings of competence are critical to the decision to take action,[14-15] lack of competence may be partially responsible for low rates of initiation.

In light of the strong evidence that other factors are responsible for the low rates of bystander CPR, we urge that the American Heart Association (AHA) vigorously promulgate the authors' recommendation that "current CPR guidelines for performing mouth-to-mouth ventilation during CPR should not be changed," and maintain the longstanding opinion, well supported by research, that the risk of infection, particularly HIV, presented by mouth-to-mouth ventilations is minimal. We further urge that:

a. the argument that laypersons do not initiate CPR because of fear of performing mouth-to-mouth breaths be disavowed unless new studies reveal this to be a significant contributory cause;

b. the call for further research on the efficacy of chest compressions without ventilations be tabled;

c. the training organizations target CPR training to laypersons with high exposure to individuals with heart disease;

d. the training organizations improve CPR training programs to produce, at the very least, competent CPR performance immediately following training;

e. the Emergency Cardiac Care Committee and training organizations address laypersons and medical professionals as separate populations requiring different curricula, teaching methods, and expert committees; and

f. the AHA initiate and support research related to lay bystander response.

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REFERENCES

1. Becker LB, Berg RA, Pepe PE, Idris AH, Aufderheide TP, Barnes TA, Stratton SJ, Chandra NC. A reappraisal of mouth-to-mouth ventilation during bystander-initiated cardiopulmonary resuscitation. Respir Care 1997;42(9):895-906.
2. Safar P. Mouth-to-mouth ventilation during bystander CPR (letter). Respir Care 1998;43(2):122-123.
3. McCormack AP, Camon SK, Eisenberg MS. Disagreeable physical characteristics affecting bystander CPR. Ann Emerg Med 1989;18(3):283-285.
4. Goldberg JJ, Gore JM, Love DG, Ockene JK, Dalen JE. Layperson CPR—are we training the right people? Ann Emerg Med 1984;13(9, Part 1):701-704.
5. Brennan RT. Student, instructor, and course factors predicting achievement in CPR training classes. Am J Emerg Med 1991;9(3):220-224.
6. Pane GA, Salness KA. A survey of participants in a mass CPR training course. Ann Emerg Med 1987;16(10):1112-1116
7. Lombardi G, Gallagher J, Gennis P. Outcome of out-of-hospital cardiac arrest in New York City. The pre-hospital arrest survival evaluation (PHASE) study. JAMA 1994;271(9):678-683.
8. Eisenberg MS, Horwood BT, Cummins RO, Reynolds-Haertle R, Hearne TR. Cardiac arrest and resuscitation: A tale of 29 cities. Ann Emerg Med 1990;19(2): 179-186.
9. Becker LB, Ostrander MP, Barrett J, Kondos GT. Survival from cardiopulmonary resuscitation in a large metropolitan area—where are the survivors? Ann Emerg Med 1991;20(4):355-361.
10. Litwin PE, Eisenberg MS, Hallstrom AP, Cummins RO. The location of collapse and its effect on survival from cardiac arrest. Ann Emerg Med 1987;16(7):787-791.
11. Atkins JM, Zachariah BS. Location of cardiac arrests: implications for AED placement. Prehospital Disaster Med 1996;11 (Suppl):47.
12. Shotland RL, Heinold WD. Bystander response to arterial bleeding: helping skills, the decision-making process, and differentiating the helping response. J Pers Soc Psychol 1985;49(2):347-356.
13. Darley JM, Latané B. Bystander intervention in emergencies: diffusion of responsibility. J Pers Soc Psychol 1968;8(4): 377-382.
14. Mogielnicki RP, Stevenson KA, Willemain TR. Patient and bystander response to medical emergencies. Med Care 1975; 13(9):753-762.
15. Piliavin IM, Rodin J. Good samaritanism: an underground phenomenon? J Pers Soc Psychol 1969;13(4):289-299.
16. Latane B, Darley JM. Group inhibition of bystander intervention in emergencies. J Pers Soc Psychol 1968;10(3):215-221.
17. Latane B, Nida S. Ten years of research on group size and helping. Psychol Bull 1981;89:308-324.
18. Piliavin JA, Piliavin IM. Effect of blood on reactions to a victim. J Pers Soc Psychol 1972;23:353-361.
19. Shotland RL, Stebbins CA. Emergency and cost as determinants of helping behavior and the slow accumulation of social psychological knowledge. Soc Psychol Q 1983;46:36-46.
20. Locke CJ, Berg RA, Sanders AB, Davis MF, Milander MM, Kern KB, Ewy GA. Bystander cardiopulmonary resuscitation: concerns about mouth-to-mouth contact. Arch Intern Med 1995;155(9):938-943.
21. Braslow A, Brennan RT, Newman MM, Bircher NG, Batcheller AM, Kaye W. CPR training without an instructor: development and evaluation of a video self-instructional system for effective performance of cardiopulmonary resuscitation. Resuscitation 1997;34(3):207-220.
22. Brennan RT, Braslow A. Skill mastery in cardiopulmonary resuscitation training classes. Am J Emerg Med 1995;13(5):505-508.
23. Brennan RT, Braslow A. Skill mastery in public cardiopulmonary resuscitation classes. Am J Emerg Med (1998, in press).
24. van Kalmthout PM, Speth PAJ, Rutten JR, Vonk JTC. Evaluation of lay skills in cardiopulmonary resuscitation. Br Heart J 1985;53(5):562-566
25. Mandel LP, Cobb LA. Initial and long-term competency of citizens trained in CPR. Emerg Health Services Q 1982;1:49.
26. Wik L, Steen PA, Bircher NG. Quality of bystander cardiopulmonary resuscitation influences outcome after prehospital cardiac arrest. Resuscitation 1994;28(3):195-203.
27. Lund I, Skulberg A. Cardiopulmonary resuscitation by laypeople. Lancet 1976; 2(7988):702-704.
28. Van Hoeyweghen RJ, Bossaert LL, Mullie A,Calle P, Martens P, Buylaert WA, Delooz H. Quality and efficiency of bystander CPR. Belgian Cerbral Resuscitation Study Group. Resuscitation 1993; 26(1):47-52.

The authors respond:

We wish to thank Drs Braslow and Brennan for highlighting the importance of educational research on the teaching of layperson cardiopulmonary resuscitation (CPR). While the issue of 'why people don't perform CPR' was not the focus of our recent paper, we agree that these are important issues. Drs. Braslow and Brennan have made many critical contributions to our understanding of how people learn CPR. They have been pioneers in developing techniques for objective evaluation of CPR training outcomes, peer-training methods, and video self-teaching methods. As experts in the education of layperson CPR, their insights and perspective are valuable.

We appreciate the opportunity to expand several points of our manuscript:

- 'Fear' of acquired immunodeficiency syndrome (AIDS) is not the *primary* reason people fail to perform CPR, it is only one of the barriers to CPR performance. We contend that the primary reason CPR is not performed is related to training obstacles—not fear of infection. Failure to provide effective CPR by the lay rescuer represents a real failure to save lives. Additional resources must be targeted to improve lay bystander response.

- In our paper, we discuss fear of disease transmission along with several other issues (including pulmonary aspiration, carbon dioxide, and time taken away from compression). These are possible adverse side effects specific to mouth-to-mouth ventilation. Few medical therapies are without side effects—CPR and mouth-to-mouth ventilation are no exception. Our responsible reappraisal of CPR had to include a consideration of these side effects. After careful review the Task Force concluded, "Current guidelines for performing mouth-to-mouth ventilation during CPR should not be changed." Suggestions that the article states otherwise misrepresent the article.

- We think bystanders considering mouth-to-mouth contact do voice concerns about HIV. The available data supports this statement. Locke et al[1] reported on 975 survey respondents of whom 80% were laypersons. They concluded that laypersons are reluctant to provide mouth-to-mouth ventilation and that layperson reluctance is a barrier to CPR provision even in relatives and close friends. Moreover, we know from our training network that concerns over disease transmission (and most specifically human immunodeficiency virus or HIV) continue to be

an issue raised by participants taking CPR courses. To answer these concerns, we first respond that most CPR will be performed on family members and that the actual risk of disease transmission is extremely low. However, for those who may delay or not begin CPR due to persistent fears, we have a duty to at least provide clear instructions to begin immediate chest compressions. We know that chest compression alone has been lifesaving for many. We know that the lowest survival rate occurs when no efforts are attempted.[2-4]

- Are research funds better spent on determining improved methods to teach CPR to the public or should we be concentrating on further research into the physiology and improved mechanics of the "pump and blow" techniques? There has been a scarcity of research on the methodology of teaching CPR to the public. By contrast, relatively more research has been published on the physiology of blood flow and survival with CPR techniques. However, it seems to us that both are still required. While educational issues are important, no one would advocate the teaching of a noneffective technique simply because it was easy to teach, well retained, and easy to perform. Likewise no technique would be useful, even if it resulted in near-perfect blood flow during CPR, if bystanders could never acquire the skills to perform the task. Some balance is necessary. Our position on funding is that the whole field of resuscitation and CPR research has been under-funded relative to its importance for public safety. It does not make sense to argue 'over mere nickels' when we need serious dollars to make headway and save more lives.

We look forward to continued contributions and perspectives on CPR training and techniques, for this intervention is a major public health issue that can directly impact the lives of many citizens.

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2. Van Hoeyweghen RJ, Bossaert LL, Mullie A, Calle P, Martens P, Buylaert WA, Delooz H, Belgian Cerebral Resuscitation Study Group. Quality and efficiency of bystander CPR. Resuscitation 1993;26:47-52.
3. Bossaert L, Vanhoeyweghen R, Cerebral Resuscitation Study Group. Bystanders cardiopulmonary resuscitation (CPR) in out-of-hospital cardiac arrest. Resuscitation 1989;17(Suppl):S55-S69.
4. Lombardi G, Gallagher J, Gennis P. Outcome of out-of-hospital cardiac arrest in New York City: the Pre-Hospital Arrest Survival Evaluation (PHASE) Study. JAMA 1994;271:678-683.

Contributing Author Salutes Pat Brougher

In the September issue of Respiratory Care,[1] I read with both surprise and disappointment that Pat Brougher will no longer be the editor of our excellent science journal. I agree with Dr Pierson's assessment that Pat's contribution to the practice of respiratory care via her superior guidance in the production of this journal has been a genuine benefit to our organization and profession as a whole. Speaking as a contributing writer and reviewer, I can say Pat consistently and graciously was both a mentor and encourager for those of us interested in writing and publishing. She has always been helpful and prompt in her correspondence and exemplifies the best an editor can be in getting people started in publication and retaining them as subsequent writers. Her integrity, courtesy, alacrity, and professionalism as an editor will be hard to match.

Both our profession and those of us who have been contributing authors owe her a great deal. Thank you, Pat, for everything. You will be missed!

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REFERENCES

1. Pierson DJ. Pat Brougher—we owe her much. Respir Care 1997;42(9):842-843.

Improvement in Oxygenation in the Adult Respiratory Distress Syndrome by Positive End-Expiratory Pressure (PEEP)*

Thomas L Petty MD, Louise M Nett RN ARIT, David Ashbaugh MD

The adult respiratory distress syndrome is characterized by marked dyspnea, tachypnea, profound hypoxemia in spite of supplemental oxygen or conventional ventilatory assistance, marked pulmonary infiltration on chest roentgenograms, and markedly impaired effective compliance. The clinical syndrome is a response to a variety of pulmonary injuries including profound shock—either septic or hemorrhagic (hypovolemic), massive aspiration pneumonia, overwhelming viral pneumonitis, direct chest trauma, diffuse intravascular coagulation, and probably a variety of additional diffuse pulmonary insults.[1,2] The basic mechanism appears to be damage to the alveolar-capillary membrane with leakage of plasma and red cells. Mechanics of ventilation are impaired due to the presence of fluid and/or the loss of surfactant activity, and transport of oxygen across the alveolar-capillary membrane is decreased.

The immediate problem in management is correction of hypoxemia and improvement of tissue oxygen transport. Studies from our laboratory have clearly indicated that alteration of the pressure wave form during the exhalation phase of ventilation has a marked beneficial effect in improving arterial oxygenation.[1,4] The maneuver that is most effective is exhalation against a positive end-expiratory pressure (PEEP). (This has previously been designated "continuous positive pressure breathing" (CPPB)). The conventional pressure wave form of a volume ventilator is shown in Figure 1, along with the effect of 10 cm H_2O PEEP. It is stressed that end expiratory pressure persists throughout the expiratory phase.

This important ventilatory maneuver greatly enhances oxygen transport as illustrated in our previous reports and by Table 1. This table presents the inspired oxygen tension during ventilation with a volume ventilator (Ohio 560) following severe chest trauma and shock and the subsequent development of the adult respiratory distress syndrome The patient was first ventilated with large tidal volumes which reduced the difference between the inspired and arterial oxygen tensions (and index of oxygen transport across the lung); later, inspiratory plateau was added. This ventilatory maneuver, may be useful in improving ventilation-perfusion relationships during inhalation. The added effectiveness of PEEP is seen in the far right column. This actually produced a greater than normal arterial tension, so the patient could be managed with lower oxygen fraction. Improvement in oxygenation in a patient with acute hemorrhagic pancreatitis and shock is demonstrated in Table 2.

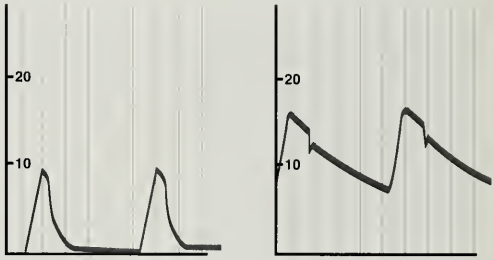


Fig. 1. Left—normal pressure wave form with exhalation against atmospheric pressure. Right—exhalation against 10 Cm H_2O PEEP.

Table 1. *Adult Respiratory Distress Syndrome*

Improved oxygen transport with Positive End-Expiratory Pressure (PEEP): 44-year-old male with multiple trauma liver laceration; 40 units whole blood, 8 liters Ringer's lactate.*

	2 P.M. Operating Room	4 P.M. Volume Respirator, V_T 1000 ml	4:30 P.M. Inspiratory Hold, 2 sec.	5 P.M. Inspiratory Hold and 10 cm PEEP
P_IO_2	570	345	345	345
P_aO_2	81	82	101	151
P_aCO_2	27	25	23	25

* Courtesy of D. Boyd Bigelow MD, Chief of Respiratory Diseases, St. Anthony's Hospital, Denver, Colorado. Reproduced by permission of the Editor of CHEST.

*From the Respiratory Care Unit, Department of Medicine and Surgery, University of Colorado Medical Center, Denver, Colorado.

Reprinted from Respir Care 1971;16(4):173-176.

Table 2. *Adult Respiratory Distress Syndrome*

56 year-old female with acute hemorrhagic pancreatitis and shock.

	1 P.M.	1:30 P.M. 10 cm PEEP	2 P.M. No PEEP	2:30 P.M. 10 cm PEEP
P_IO_2	560	555	550	560
P_aO_2	44	125	45	135
P_aCO_2	30	32	30	33
V_T	700	725	700	700

PEEP probably improves oxygen transport across the lung by maintaining an increased functional residual capacity and thereby preventing alveolar collapse and shunting during expiration.[3] In the presence of the stiff lungs of the adult respiratory distress syndrome, the use of both high inflation pressures and 5-15 cm PEEP does not cause significant interference with venous return and cardiac output.[4,6]

A number of additional terms have been applied to the same ventilatory maneuver.

Continuous Positive Pressure Breathing (CPPB). We originally used this term because positive pressure breathing occurs not only during the inspiratory phase but also the expiratory phase. Unfortunately, however, this term has been somewhat confusing because it had earlier been introduced to indicate constant positive pressure breathing during both phases of respiration.[7]

Positive End Pressure Plateau (PEEP). This phrase has also been used in the literature and is a perfectly reasonable term.[5] This term fails to indicate that the back pressure exists throughout the entire expiratory phase, although the words "End Pressure Plateau" imply this.

Expiratory Retard or Hold. This term refers to the slowing of exhalation by attaching various sizes of small obstructions to the exhalation port. In this situation, however, the expiratory pressure reaches atmospheric level before the next inspiratory wave form starts.

At least four commercially available ventilators commonly used in this country have PEEP controls as standard or accessory features. These are the Engstrom respiratory, which has a spring-loaded disk on the exhalation port; the Ohio 560 respirator, which provides back pressure against the exhalation manifold balloon; the Bennett MA-1, which provides the PEEP accessory seen in Figure 2: this also exerts back pressure at the exhalation manifold via the occluding balloon; and the Emerson ventilator, which also uses a spring-loaded disk.

Fig. 2 View of Bennett MA-1 respirator showing (left) spot for location of PEEP accessory; (right) PEEP accessory installed.

All respirators that do not have the PEEP feature or accessory, including the pressure cycled machines, can be adapted by simple attachments to provide the same effect. Figure 3

Fig. 3. Production of PEEP by venting exhaled gas underwater. Amount of PEEP is controlled by depth of tube underwater. Bottle must be vented.

shows how the exhalation port can be attached to an underwater seal via connecting tubing. The amount of PEEP is then regulated by the depth of the tubing underwater. Note the distension of the test balloon on expiration and the pressure indicated on the gauge. Some pressure-cycled devices must be equipped with a one-way valve in the manifold to prevent pressure leaks back through the central valving mechanism, Figure 4.

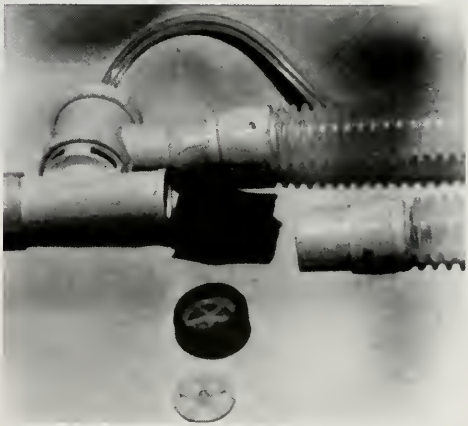


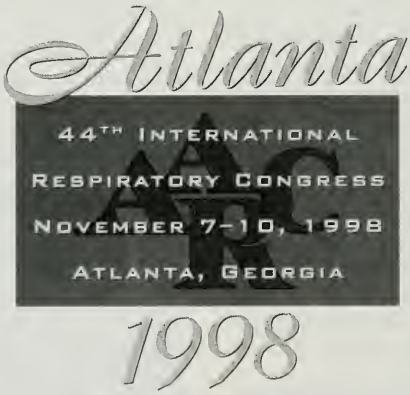
Fig. 4. Placement of one-way valve in main gas delivery tubing of pressure-cycled respirators prevents backflow of gas during exhalation period.

Summary

PEEP is a valuable ventilatory maneuver for improving oxygenation in the adult respiratory distress syndrome. The pressure wave form probably increases oxygen transport by increasing functional residual capacity and preventing alveolar collapse. All respirators can be adapted to provide PEEP by using an underwater seal connected directly to a gas-collecting manifold.

REFERENCES

1. Ashbaugh DG, Bigelow DB, Petty TL & Levine BE: Acute respiratory distress in adults, Lancet 2:319, 1967.
2. Petty TL & Ashbaugh DG: The adult respiratory distress syndrome (clinical features, factors influencing prognosis, and principles of management), Chest (in press).
3. Ashbaugh DG, Petty TL, Bigelow DB & Harris TM: Continuous positive pressure breathing in adult respiratory distress syndrome, J Thorac Cardiovasc Surg 57:31, 1969.
4. Uzawa T & Ashbaugh DG: Continuous positive pressure breathing in acute hemorrhagic pulmonary edema, J Appl Physiol 26: 427, 1969.
5. McIntyre RW, Laws AK & Rainachandran PR: Positive expiratory pressure plateau, improved gas exchange during mechnical ventilation, Anes Soc J 16:477, 1969.
6. Faulke KJ, Pontopiddan H, Kumpe A, Geffin B & Laver MP: Effect of continuous positive pressure on cardiac output and lung function. (Presented at American Society of Anesthesiologist's meeting, New York, 1970).
7. Barach Al, Martin J & Exkman M: Positive pressure respiration and its application to the treatment of acute pulmonary edema, Ann Intern Med 12:754, 1938.
8. Ashbaugh DG: Effect of ventilatory methods and patterns on physiologic shunt, Surgery 68:99, July 1970.



RETROSPECTROSCOPE REDUX:

Who Was Alexis *Who?*

In 1974, before beginning a talk to a group of cardiovascular scientists at their national meeting, I gave each a card that had this request at the top: "Without consulting anyone, please write after each man's name what you consider to be his main contribution to biomedical science." There followed four names, one of which was Alexis Carrel. When I tabulated their answers, I found that only 7 of all 111 who returned their cards knew of Carrel's great contributions to vascular surgery, 33 knew only of his later work on organ culture, and 71 wrote after Carrel's name "NHOH"—"never heard of him."

Carrel won the Nobel Prize in Physiology or Medicine in 1912, and he won it not for some obscure, esoteric research but "in recognition of his work on vascular suture and the transplantation of blood vessels and organs."* Between 1901 and 1910, Alexis Carrel, using experimental animals, performed every feat and developed every technique known to vascular surgeons today (except for using a dissection microscope and tubes made of synthetic materials). He reunited vessels, inner lining to inner lining; he sutured artery to artery, vein to vein, artery to vein, and did this end to end, side to side, and side to end. He used patch grafts, autografts,† homografts, rubber tubes, glass tubes, metal tubes, and absorbable magnesium tubes. He devised his own nontraumatic needles, clamps, and sutures (1). He performed a coronary bypass operation on a dog using a preserved carotid artery; for him, the procedure required only 5 minutes. He preserved vessels, tissues, and organs by refrigerating them in Locke solution. He suggested using a segment of a patient's vein to replace a damaged artery. He transplanted the thyroid gland, spleen, ovaries, limbs, kidneys, and even a heart and so proved that, surgically, it was possible and easy to transplant organs. But he recognized that a homograft (Carrel used the correct term homotransplant) vessel served only as a framework for new cell growth. And as early as 1912, he stated: "But it is not yet known whether surgeons will ever be able to perform a homoplastic transplantation with permanent success ... it will only be through a more fundamental study of the biological relationships existing between living tissues (... to recognize individuals, if such exist, between whom organs can be interchanged with impunity) that the problems involved will come to be solved" (1).

Despite his unique achievements, the vast majority of American physicians and surgeons believe today that vascular surgery and organ transplantation sprang, like Athena from the skull of Zeus, full-grown from the skulls of imaginative, daring, and skillful surgeons of the 1940s and 1950s. This odd situation required answers to three questions: *(1)* who was Alexis Carrel? *(2)* what did he do to deserve the 1912 Nobel Prize? and *(3)* why was his work essentially lost for 35 or 40 years?

Who Was Alexis Carrel?

His story has been told elsewhere (2-4). He was born in Lyons, France in 1873. Between 1890 and 1901, he went to medical school at the University of Lyons (3 years), then spent two years in hospital service, one year in military service, and five years in internship in hospitals in Lyons. Thereafter, he devoted himself to experimental vascular surgery.

Why vascular surgery? You may recall that John Gibbon, who developed the heart-lung machine that made open-heart surgery possible, did it because while a research fellow at Massachusetts General Hospital, he saw a patient die when a massive pulmonary embolus had lodged in his main pulmonary artery. At that moment, Gibbon knew that the embolus could have been removed surgically and the patient's life saved if only the chief surgeon had had at hand an artificial heart-lung machine that could keep the body supplied with arterial blood long enough for the surgeon to open the chest, incise the pulmonary artery, extract the embolus, and sew up the pulmonary artery and the chest.

*To be honest, I, too, was unaware until about 10 years ago that he won a Nobel prize for vascular surgery.

†Autograft or autotransplant is a transfer of tissue or organ into a new position in the same person or animal; homograft or homotransplant is a transfer to another member of the same species (e.g., man to man, dog to dog); heterograft or heterotransplant is transfer to another species of animal.

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Carrel, a young intern in 1894, was deeply impressed by the assassination of Sadi Carnot, President of the French Republic; the fatal knife wound had severed the portal vein, and the best surgeons of France were helpless. Carrel firmly believed that Carnot could have been saved if surgeons had learned to sew up blood vessels just as they sewed together muscle, skin, and other tissues. Only a few surgeons were then interested in operating on blood vessels. Some of these were Jaboulay and Briau (in Carrel's hometown of Lyons), who reported on arterial suture in 1896 (5); Murphy in Chicago, who published an account of his successful end-to-end joining of a severed femoral artery in 1897 (6); Dörfler in Germany, who in 1899 described his principles for successful repair of vessels (7); Payr, who in 1900 devised resorbable tubes to connect cut ends of blood vessels (8); Matas in New Orleans, who in 1903 devised a method for repairing an arterial aneurysm (9); and Hoepfner in Germany who used Payr's tubes and other techniques to reunite vessels (10). Yet Hufnagel (3) stated that by 1900 surgeons had sutured only nine human arteries successfully (success = vessel was still open postoperatively), and all nine of these became obstructed later. So it was not a flowering field that Carrel entered when he began his experimental work on vascular suture in 1901.

His first paper, "La technique opératoire des anastomoses vasculaires et la transplantation des viscères," appeared in *Lyon Médical* in 1902 (11); although he had previously published 24 papers (including two on popliteal aneurysm), the 1902 paper really marked the beginning of his unique career. Why did he succeed when others had either failed or had serious problems? One reason was his manual dexterity; Carrel attributed this to instruction he received from Mme. Leroudier, a superb embroidress in Lyons, who gave him lessons at her home during his internship (4). Another was his insistence on avoiding trauma to vascular tissues by use of extremely fine smooth needles (here again he got help from a "lace woman" in Lyons) and lubricated thread. A third was the exceedingly strict aseptic techniques he used in his operations—far more rigid than those then in use by surgeons in any other specialty.

From Lyons to Montreal to Chicago

Why did Carrel leave Lyons, France, and clinical medicine and surgery? Edwards and Edwards (4) attribute this in part to the "Miracle at Lourdes." In May 1903, Carrel accepted an invitation to travel with the trainload of the sick who were making a pilgrimage to the shrine at Lourdes, in part to attend to the sick and in part as a medical scientist and a skeptic, to observe at first hand the allegedly miraculous cures. En route, Carrel examined a gravely ill girl, Marie Bailly, who, to Carrel, appeared to be dying of tuberculous peritonitis, a disease of which both her parents had died. The next day, because this patient was unconscious and too sick for the usual immersion, she was sprinkled with a bit of holy water from the pool. That afternoon she began a remarkable recovery and lived in a religious service until 1937 (she came within seven years of outliving Carrel!). Carrel, although mystified and dumbfounded, dutifully reported his observations to the medical community in Lyons. He was attacked by the clergy for being unduly skeptical and by his medical colleagues for being unduly gullible. One of his surgical colleagues told him that he would now never pass his surgical examination. In May of 1904, he left France for the New World, initially Canada.

In early July in Montreal, he presented a paper on vascular anastomosis to the Second Medical Congress of the French Language of North America. In the audience was Dr. Carl Beck, a well-known Chicago surgeon who at once was convinced that Carrel belonged in Chicago. In November of that year, Carrel was offered two positions in Chicago, one at the University of Illinois with Beck and another at the University of Chicago in the Department of Physiology. He accepted the position in physiology, probably because G. N. Stewart was chairman of that department. Stewart was a cardiovascular physiologist, still famous today for his dye-dilution principle for measuring blood flow. But he was also somewhat of an experimental cardiovascular surgeon; indeed, in 1910 he devised the famous "Potts clamp" of 1946 that permitted flow to continue through a lateral channel in a large artery, while the other channel remained bloodless so that a surgeon could cut and stitch it.

Carrel at the University of Chicago

Stewart assigned Carrel to work with Charles Claude Guthrie, a young physiologist seven years Carrel's junior. They worked together for a 21-month period between November 1904 and August 1906; actually, their direct association was for only 12 months, because Guthrie was on sabbatical leave at the University of Missouri for 9 of the 21 months. During the Chicago period, they jointly wrote 28 papers, Carrel an additional five, and Guthrie two more (on cardiac resuscitation). It was obviously a highly productive collaboration. They reimplanted or transplanted arteries, veins, kidneys, thyroid gland, ovaries, and even a thigh. Some have questioned in later years whether these triumphs in experimental surgery that always involved joining an artery to an artery, a vein to a vein, an artery to a vein, or some combination of these, were due to the skill of Carrel, or Guthrie, or to their combined skills. Indeed Guthrie himself, in a letter published in 1909 in *Science*, wrote (12):

> Modesty should prevent, but I am unable to refrain from remarking in passing that it is a singular fact that, up till the time Carrel and I engaged in the work together, he reported that his experiments did not always yield good results, and that *our results almost from the beginning of our worst together were excellent!* Indeed, so far as I have been able to determine, Carrel working first with Berard, then with Morel in France, and later by himself in Dr. Carl Beck's laboratory in Chicago,

> claims only one permanently successful result. This was an arterio-venous anastomosis made with Morel between the jugular vein and carotid artery of a dog. The animal was under observation but a short time and ultimately was lost, so no direct examination of the result was made. But in all probability it would have remained good.

I knew neither Guthrie nor Carrel personally and have no first-hand basis for judging who deserves how much credit for what during that remarkable year in Chicago. One can, of course, speculate by looking at their subsequent scientific careers, because the close collaboration of the two came to an end in 1906 when Guthrie accepted the professorship of physiology and pharmacology at Washington University in St. Louis (and three years later moved to a similar post at the University of Pittsburgh), and Carrel went to work in the new experimental surgery unit at the Rockefeller Institute for Medical Research in New York. After 1906, Guthrie did some good physiologic work on blood, circulation, asphyxia, and resuscitation, wrote a monograph, *Blood Vessel Surgery and its Applications,* and devised about a dozen new pieces of useful apparatus. His last 30 years at the University of Pittsburgh (1928 to 1958) were far less productive; he published only 10 papers during that period.

Before looking at Carrel's career after Chicago, it is worth pointing out that Carrel was in the vascular surgery business from 1901 onward, and indeed introduced Guthrie to it. And after Chicago, Carrel's work continued to be highly innovative, imaginative, varied, and both fundamental and practical until his death in 1944. In my opinion, the scientific talents of Carrel were unique and entitle him to the label of genius; you decide yes or no as you read further.

Carrel's Research

Although Gibbon started his research on a heart-lung machine because he believed it could have saved the life of a patient with a massive pulmonary embolus (5), he ultimately used his device for much broader purposes (i.e., the repair of cardiac defects). Similarly, Carrel, although he began research on vascular surgery because an assassin's knife severed the portal vein of the President of the French Republic, soon found that conquering the technical aspects led to far broader problems and applications.

Carrel's early research dealt with techniques for joining arteries and veins, in an era that long antedated anticoagulants such as heparin, and antibiotics such as penicillin. In retrospect, this early phase almost seemed to have been Part I of a grand plan that he could have conceived in the mid-1890s and carried forward logically step by step to its climax in the late 1930s. Once he knew how to suture vessel to vessel, he knew how to excise and *re*implant organs (except for their lymphatics) and then he knew how to *trans*plant organs (auto-, homo-, and heterotransplants). But then he had to know how

Fig.1. Alexis Carrel in his laboratory at the Rockefeller Institute in New York (1935).

long he could deprive different organs of their blood flow and still be sure that they would survive and *be functional* when he restored flow. This obviously led him to wonder whether organs could survive longer if he perfused them with special fluids instead of letting them remain bloodless. And because each organ had a different function, he reasoned that each required a unique perfusion fluid to retain its optimal function. And if he could find it, his next question was could he keep organs alive indefinitely? Were tissues, properly fed and watered with the ideal substances in a perfect environment, essentially immortal? This led him to cell, tissue, and organ culture, and, in collaboration with Charles Lindbergh, to the first germ-free pump-oxygenator.

So much for the grand plan of his scientific career, interrupted only during World War I when, with the British chemist Henry Dakin, he devised and successfully used the Carrel-Dakin solution to cleanse and combat infection in open war wounds (13). Now, although I put them in capsule form earlier, let me tell you a bit more about his achievements that led to the 1912 Nobel Prize.

On the Suture of Vessels

Carrel could successfully suture any vessel to any other—even though they were less than "a matchstick in diameter." Part of his success was a new surgical trick—"triangulation" (11). His technique was to sew along straight lines instead of sewing around a circle. How did he do this? By placing

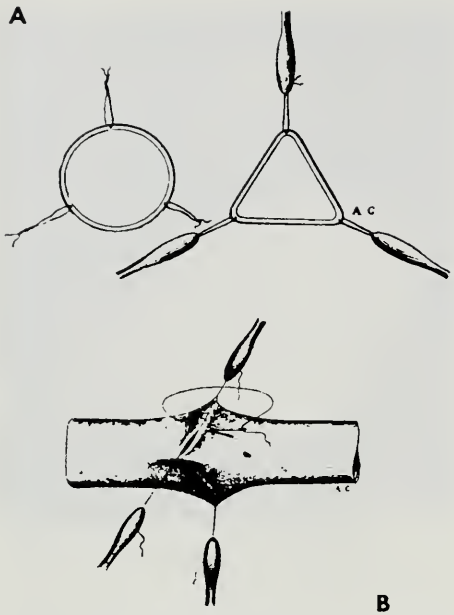

Fig. 2. (A) Schematic representation showing how Carrel transformed a circle into a triangle. (B) One side of the triangle (lower part) has already been sewn together; the second part is being stitched while the two ends of the arc are drawn into a straight line (11).

three sutures, each 120° apart, on the circumference of the cut circular ends and then pulling two of the sutures in opposite directions (figure 2); this converted an arc into a straight line and permitted him to sew together one third of the circumference. He then repeated the trick for each of the other two thirds.

Part of his success was also due to his unusual manual dexterity, part to his insistence on unheard of gentleness to tissues (he used fine, round, polished atraumatic needles and extremely fine, vaselined thread), and part to practicing aseptic techniques that went far beyond those practiced by contemporary surgeons (he was convinced that even slightly infected *vessels* healed poorly or not at all). Carrel wrote (14):

> It seems that the degree of asepsis under which general surgical operations may successfully be performed is probably insufficient for good results in vascular operations. Generally, it is considered that a wound is aseptic when it does not suppurate, and when healing occurs 'per primam intentionem.' But it should be remembered that this clinical asepsis is far from the ideal condition of absolute asepsis. Between absolute asepsis and infection, which is evidenced by the ordinary symptoms of inflammation occurring in the operated area and by suppuration, there are many intermediate degrees of attenuated infection. It is certain that every operative wound, though clinically aseptic, is more or less infected. This infection is not accompanied by the classical symptoms of inflammation; i.e., there is no fever, oedema, redness, pain, or heat of the tissues, or if these phenomena are present, they escape detection.

Edwards and Edwards wrote of Carrel's operating rooms (4):

> His laboratory rooms, necessarily guarded against bacterial contamination, acquired the aura of a sanctuary where masked acolytes clad in black gowns and caps performed the aseptic mysteries of experimental surgery and tissue culture. Early in his career Carrel adopted black surgical gowns and drapes for his operating table to cut down glare and give better visibility to the tissues upon which he performed his extremely delicate operations. People from other laboratories, fearing to carry infectious germs into the laboratory, did not drop in for casual visits and never learned what was going on, except when specially invited.

It was obvious that in the early 1900s, Carrel was approaching the modern germ-free atmosphere required for survival of patients who had few or no mechanisms for defense against bacteria.

On Preservation of Tissues *In Vitro*

Blood banks (that stored preserved whole blood or red blood cells) presumably came into being during the Spanish Civil War in 1936–1938, although Rous and Turner had shown how to preserve red blood cells as early as 1916 (15). But even a decade before 1916, Carrel recognized the importance of preserving tissues (e.g., blood vessels) *in vitro* so that they would be immediately available when needed.

In 1910, Carrel wrote (16):

> The graft must be taken from an amputated limb, or from the fresh cadaver of an executed criminal or of a man killed by accident. But such an opportunity will certainly not occur precisely when a graft is needed for an operation. The grafts, therefore, must be kept in storage and be ready for use when necessary. Such a preservation of vessels outside of the body can be obtained by placing them in a condition of latent life …
>
> The ideal method would be to place the vessels in a condition of potential life. The metabolism being completely stopped, the duration of the period of preservation could be indefinite …
>
> I began in 1906 some experiments on the preservation of arteries in cold storage. It was found immediately that a dog's carotid artery could be preserved outside of the body at a low temperature for several days and transplanted without suffering degeneration of its muscle fibers.

Carrel preserved vessels in cold storage in special saline solutions or in the animal's own serum or defibrinated blood. He also tested the usefulness of vessels that had been frozen, dried, or killed (by formalin, glycerin, or heat). His vision for vascular surgery was incredible; in 1912, he wrote (17):

> The results obtained by Tuffier [on bone, cartilage, and peritoneum], Magitot [on the cornea] and myself demonstrated that human tissues preserved in cold storage could be used in human surgery.... A supply of tissues in latent life would be constantly ready for use and the tubes containing the tissues could even be sent, in small refrigerators of the type of vacuum bottles, to surgeons who would need them. It would simplify very much the transplantations of skin, bone, periosteum and aponeuroses, which are more and more used in human surgery.

On Reimplantation of Severed Limbs

The first reimplantation of a human limb was performed in 1962 at Massachusetts General Hospital in Boston when the arm of a 12-year-old boy was successfully sewn back on after having been completely amputated just below the shoulder by a train (18). It is somewhat startling to note that the vessels, nerves, and bones were successfully reattached using the techniques employed in animals by Carrel and Guthrie in 1905 (19) and 1907 (20). Carrel noted (20):

> Replantation of the thigh always gave an excellent reestablishment of the circulation.... The thigh [was] completely amputated above the junction of its lower and middle third. After a few minutes the limb was replanted. The ends of the bone, the muscles, the vessels and the sciatic nerve were united. The circulation was reestablished after having been interrupted for one and one quarter hours.... After the operation the general and local conditions of the animal remained very satisfactory. It drank and ate normally and walked on its three sound limbs. The skin of the replanted foot remained normal, but its hue was redder and its temperature higher than that of the normal foot.... Seven days after the operation the dressing was partially removed. The limb presented neither oedema nor trophic troubles.... The skin was normal and the wound had united 'per primam intentionem' without evidence of inflammation.

On Reimplantation of the Thyroid Gland and of the Kidneys

Carrel showed in the early 1900s that, once the techniques of joining artery to artery and vein to vein were mastered, reimplantation or transplantation of organs was technically simple. He did, however, appreciate the problems of antigen-antibody reactions and rejection of foreign tissues. In 1907, he stated (20):

> Clinical applications of the transplantations of organs are so obvious that they do not need to be described. If I were a veterinary surgeon and had to treat a myxoedematous dog, I would not hesitate to transplant into its neck a thyroid gland from another dog. In a case of a dog presenting Bright's disease, it would be a rational procedure to substitute for one of his kidneys a sound kidney extirpated from some normal dog.... But the question of the transplantation of organs on man is difficult and very far from settled. In the first place, it is necessary to be sure that a transplanted organ may live in good condition after a very long time. This will be established only when a dog bearing the ... kidneys of another dog will have been kept in perfect health for years. Secondly, the difficulty of finding organs suitable for transplantation on man must be met.... In some exceptional cases it would be possible perhaps to use the kidneys of a man killed by accident. Also the organs of the anthropoid apes are perhaps able to tolerate human plasma. But nothing precise is known in that respect. Besides, anthropoid apes are very expensive, and difficult to handle. The ideal method would be to transplant on man organs of animals easy to secure and to operate on, such as hogs, for instance.... The future of transplantation of organs for therapeutic purposes depends on the feasibility of heterotransplantation. Researches must be directed along this line, but as yet we have not been able to do more than perform a few preliminary experiments.

In 1912, he was able to write (1):

> A female dog, upon which a double nephrectomy and the replantation of one kidney had been performed, continued to live in perfect health for two years and a half, at the end of which time she died of a disease unconnected with the operation. The replanted kidney was normal. These experiments thus served to show that the extirpation of a kidney, its perfusion in Locke's solution, the complete interruption of the circulation for a period of 50 minutes and the subsequent suturing of its vessels and of its ureter did not occasion any interference with its functions, even after a considerable interval of time. It was thus shown that from a purely surgical point of view the grafting of an organ is possible.

On Transplanting a Heart or Heart and Lungs

Christiaan Barnard was the first to transplant the heart of one man to another, in 1968. But the concept was far from new. Carrel and Guthrie did it in the dog as early as 1905 (19). Carrel described it and transplantation of both the heart and lung in 1907 (20):

> The heart was transplanted in several different ways. This is an example: The heart of a small dog was extirpated and transplanted into the neck of a larger one by anastomosing the cut ends of the jugular vein and the

> carotid artery to the aorta, the pulmonary artery, one of the venae cavae and a pulmonary vein. The circulation was re-established through the heart, about an hour and 15 minutes after the cessation of the beat; 20 minutes after the reestablishment of the circulation, the blood was actively circulating through the coronary system. An opening made through the wall of a small branch of the coronary vein led to an abundant hemorrhage of dark blood. Strong fibrillar contraction soon occurred. Afterward contractions of the auricles appeared, and, about an hour after the operation, effective contractions of the ventricle began. The transplanted heart beat at the rate of 88 per minute, while the rate of the normal heart was 100 per minute. A little later, tracings were taken. Owing to the fact that the operation was made without aseptic technic, coagulation occurred in the cavities of the heart after about two hours, and the experiment was interrupted.
>
> We attempted also to make the transplantation of the lungs together with the heart. Both lungs, the heart, the aorta, and vena cava of a cat one week old were extirpated and put into the neck of a large adult cat. The aorta was anastomosed to the peripheral end of the carotid, and the vena cava to the peripheral end of the jugular vein. The coronary circulation was immediately reestablished and the auricles began to beat. The lungs became red and after a few minutes effective pulsations of the ventricles appeared. But the lungs soon became oedematous, and distention of the right part of the heart occurred. This accident seems difficult of prevention. A phlegmon of the neck terminated this observation two days later.

The technique of transplanting the heart of one animal into the neck of another is now providing a valuable technique for those who are today scientifically investigating the process of rejection of cardiac tissue and what to do to prevent it (21).

On Using a Segment of a Vein to Replace an Artery

Surely the concept of using a length of a patient's own vein to replace his damaged or obstructed artery originated in the 1950s? Not so; Carrel suggested it long ago (20):

> Some of the plastic operations may lead to the establishing of new therapeutic methods. For instance, the ideal treatment of large wounds of arteries and of aneurisms would be the extirpation of the diseased portion and the immediate reestablishment of the circulation. Hitherto, in exceptional cases the continuity of the artery has been reestablished by end to end suturing. This is generally impossible on account of the gap between the cut ends of the vessel. But the continuity of the vessel would very easily be reestablished by the biterminal transplantations of a vein or of an artery. After having extirpated an aneurism, it is possible to interpose between the cut ends of the artery a segment of the neighboring vein, or of some other vein, the saphenous or the external jugular for instance. If heterotransplantations prove successful, it may be possible to interpose between the cut ends of the vessel a segment of a vessel of a lower animal, *e.g.*, hog. This would annul the risk of gangrene following the extirpation of aneurisms.

And in 1912, Carrel wrote, "On human beings ... it is always possible to find on the patient himself a segment of vein suitable for transplantation" (1). In addition, Carrel and Guthrie were the first to note that when a vein was used to replace an arterial segment in the same animal, the vein assumed arterial characteristics and became thick-walled; when an artery was substituted for a vein, the arterial wall thinned and became venous in nature (14).

On Coronary Artery Bypass

Certainly using a vein or an artery to bypass an obstruction in a coronary artery was a product of the late 1960s?* Not so. Carrel did it in 1910 (22):

> In certain cases of angina pectoris, when the mouth of the coronary arteries is calcified, it would be useful to establish a complementary circulation for the lower part of the arteries. I attempted to perform an indirect anastomosis between the descending aorta and the left coronary artery. It was, for many reasons, a difficult operation. On account of the continuous motion of the heart, it was not easy to dissect and to suture the artery. In one case I implanted one end of a long carotid artery, preserved in cold storage, on the descending aorta. The other end was passed through the pericardium and anastomosed to the peripheral end of the coronary, near the pulmonary artery. Unfortunately, the operation was too slow. Three minutes after the interruption of the circulation, fibrillary contractions appeared, but the anastomosis took five minutes. By massage of the heart,

*Favaloro is generally credited with performing the first coronary artery bypass graft in 1968 (23). Yet in 1973, an article appeared in the Journal of the American Medical Association that was reminiscent of the famous "sealed letter episode." In 1922, shortly after Banting and Best reported their discovery of insulin, Gley asked the Société de Biologie to publish a sealed letter that he had deposited with the society on February 20, 1905, announcing his own discovery of the internal secretion of the pancreas. The 1973 "sealed letter" (by Garret, Dennis, and DeBakey [24]) told of using the patient's saphenous vein as a bypass from the ascending aorta to the anterior descending coronary artery beyond an obstructed segment. The date of the operation was November 23, 1964; the hour of the day was not reported. Why the Houston team, usually prompt in reporting surgical successes, waited nine years to publish notes on a single case will long remain a mystery, as will the editor's reason for publishing their single case report at a time when others were reporting hundreds. Incidentally, neither the DeBakey team nor Favaloro mentioned Carrel's 1910 paper in the *Annals of Surgery*.

> the dog was kept alive. But he died less than two hours afterwards. It shows that the anastomosis must be done in less than three minutes.

On Cardiac Surgery

Carrel, as early as 1910, knew that certain cardiac lesions could be corrected surgically if the operation could be performed quickly, before brain damage occurred. Alone and with Tuffier, he performed several types of operations on the pulmonary arteries of dogs and predicted the use of commissurotomy in man (25, 26).

> Three kinds of operation were performed: cauterization, suture and section, and suture of the valves. The cauterization of the valves was performed with the fine point of the thermocautery. The points of insertion of the valves, their free edge, or their internal surface were cauterized. The suture of the valves was made with a straight needle No. 16 and fine silk sterilized in vaselin. The left and right valves were united by one stitch at a distance of about two millimeters from the insertion to the arterial wall. This produced stenosis of the pulmonary orifice. Section and suture of one sigmoid valve were made in the following way: The sigmoid valves having been exposed by a long incision through the orifice, the right sigmoid was cut in its middle with the scissors, as far as the insertion to the arterial wall. Afterwards the edges of the wound were united near the margin of the valve by a stitch made with straight needles No. 16 and silk sterilized in vaselin ...
>
> When the interruption of the circulation did not last more than two or two and one half minutes there was no need of massage; after a few minutes the heart had recovered its normal pulsations (25).
>
> These experiments show that it is possible to perform an operation, the object of which is to increase the circumference of the pulmonary orifice, without involving much danger to the life of the animal. It is probable that operations of this type may come to be employed in the treatment of stenosis of the pulmonary artery in man (26).

On Whole Body Perfusion (Cardiopulmonary Bypass)

Carrel spent many years working on tissue culture and organ perfusion. He kept a chick's heart pulsating *in vitro* for months, maintained a strain of connective tissue alive *in vitro* for decades (27), and cultivated human sarcoma cells outside the body (28). These techniques later contributed to the successful growth of polio virus *in vitro*. However, he never devised a system for perfusing a whole human body. He came close during the 1930s, when Charles Lindbergh collaborated with him at the Rockefeller Institute. Lindbergh, in the foreword to the Edwards's book (4), tells how he came to know and work with Carrel:

> I was introduced to Carrel through a mutual friend, Doctor Paluel Flagg, an anaesthetist. The circumstances give insight to Carrel's character and standing, and to the status of surgery in 1930. They root into a family emergency.
>
> My wife's older sister had developed a seriously defective heart valve as a complication of rheumatic fever. I had asked her doctor why surgery would not be beneficial. He replied that the heart could not be stopped long enough to permit a surgical operation. I asked why an artificial heart could not be used during the operation. He said he didn't know, and showed little interest in the problem. I asked other doctors. To my amazement, none of them could tell me, and none seemed to have much interest until I came to Paluel Flagg. He said that while he could not answer my questions, he had a friend who could—the French surgeon Alexis Carrel.
>
> In his department and during lunch at the Rockefeller Institute, Carrel explained problems of coagulation, hemolysis, and infection. He said he had been trying for years to develop an apparatus similar to an artificial heart, one that would perfuse living organs isolated from the body. He showed me two mechanical devices that had been unsuccessful. I told him I thought I could construct a better perfusion apparatus. He replied that I would be welcome to the facilities of his department in the attempt to do so.
>
> My original objective in working with Carrel was to develop a successful perfusion apparatus as a step toward an artificial heart.

Lindbergh never developed an apparatus suitable for open heart operations in man, but made a considerable contribution to long-term tissue and organ culture (29), and his apparatus, in modified form, has served to maintain and preserve human kidneys until they can be transplanted (30). Figure 3 shows his 1938 perfusion pump assembly. Figure 4 is a facsimile of Lindbergh's article in *Science* (31), one of the shortest articles ever published and probably the only unsigned scientific article to appear in *Science*.

On Increasing Cerebral Circulation

Carrel also speculated on surgical procedures to improve impaired circulation to the brain (14, 20):

> We tried to increase the circulation of the brain by directing a strong current of red blood through the internal jugular vein, the peripheral end of this vein being anastomosed to the central end of the common carotid artery.

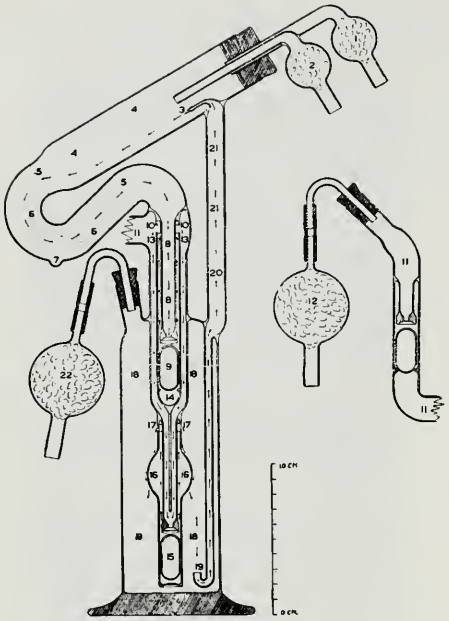

Fig. 3. The Lindbergh apparatus for culture of whole organs (29).

> After this operation no clinical troubles occur in the dog, a dog operated on five months ago is living in good health, but it might not be the same in man, as in the latter the internal jugular vein is more important than in the former. This idea of using the veins to conduct the red blood to the brain is not a new one. Jaboulay in 1902 expressed the opinion that an arterio-venous anastomosis might have a good result in case of insufficient circulation, as in softening of the brain. I do not think that this kind of lesion can be successfully treated, but it is not absolutely improbable that a slow and progressive disease such as cerebrosclerosis might be benefited by an operation modifying the circulation. But on account of the special conditions of the circulation of the brain, the substitution of veins for arteries to advantage when the latter are rendered useless by some pathological processes, is doubtful (20).

On the Fate of Transplanted Vessels

Carrel and Guthrie recognized early that, except for autotransplants (vessel removed from one animal and transplanted elsewhere in the same animal), other transplanted vessels no longer lived and grew but simply served as fibrous tubes—as a framework or scaffolding that eventually became covered by a membrane of the recipient's own cells. He noted that when any dead (but preserved) vessel is transplanted, its muscle cells degenerate rapidly, while the elastic and connective tissue can remain reasonably normal. But, even before new cells from the host cover the donated tube, the vessels remain water- or at least blood-tight and are admirable conduits for blood.

Carrel wrote in 1910 (16):

> The host reacts against the dead vessel by forming around it a tube of dense connective tissue. A devitalized vessel [thus] acts as a foreign body.... On the intima of the dead vessels, the blood deposits a thin layer of fibrin, and it is possible that the dead structure is progressively resorbed and replaced by the connective tissue of the host. The devitalized artery is a resorbable foreign body.

Almost all of the experiments done by Carrel on preserving vessels and on the use and fate of transplanted vessels were repeated and published in 1948 (32) by the "father of vascular surgery" (Dr. Robert Gross); his 1948 article lists only 3 references: Gross & ——— (unpublished); Gross, ———, & ——— (in press) and Gross, ———, & ——— (in press).

Why Was Carrel's Work Lost?

When questioned nowadays, surgeons give a variety of reasons for not recognizing Carrel's work. Several rather incredible reasons offered by today's surgeons for lack of recognition of Carrel's work in vascular surgery are his "mystical" inquiry into the immortality of organs, tissues, and cells (by perfecting organ perfusion and tissue culture methods), and his reputed pro-Nazi sympathies with Pétain and the Vichy Government in World War II—incredible because his work on vascular surgery was done even before World War I!

One startling answer (given by several surgeons) was: "Carrel wasn't first; Jaboulay did vascular surgery several years before Carrel." I shouldn't have been startled because the response was exactly the same to Harvey's discovery of the circulation of the blood. As Cruikshank reported in 1790 (33):

> When Harvey discovered the circulation of the blood, his opponents first attempted to prove that he was mistaken; but finding this ground untenable, they then asserted that it was known long before; Servetus, Columbus, and Cesalpinus, all knew it: and when they were informed, that if these gentlemen did know any thing of the matter, the world at large were totally ignorant of the fact, and likely to have continued so, except for Harvey, they once more shifted their ground, and said the discovery was of no use.

The reason offered most often by surgeons today is indeed that Carrel's discovery was of no use. Why? Because most patients requiring vascular surgery are on a battlefield and their wounds are contaminated by dirt or even manure; even Car-

566 SCIENCE VOL. 73, No. 1899

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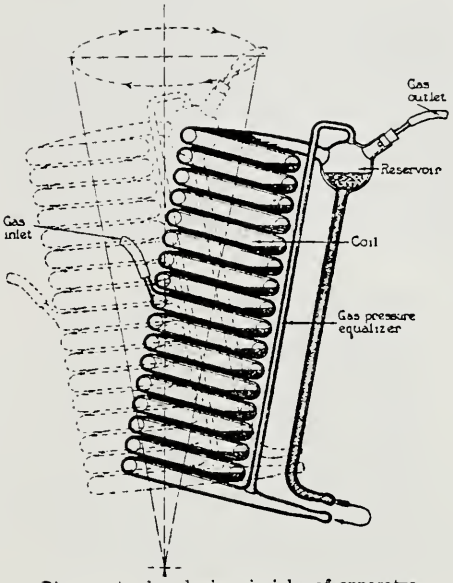

Diagram to show basic principles of apparatus.

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Fig. 4. Lindbergh's description of his first pump, 1931 (31).

rel said that repair of vessels requires asepsis. Of 2,471 arterial injuries sustained by American troops in World War II, only 81 were repaired; the rest were treated by tying off the artery, and 49 per cent of these limbs were then amputated. Of course, if a surgeon was determined to do vascular surgery on battlefields, he might have forced the development of antibiotics; Tyndall wrote of penicillium in 1877, Waksman had streptomycin in his hands in 1916, Jacobs and Heildelberger had sulfanilamide in 1916, and Fleming found penicillin in 1929. If the rejoinder was, "But we had no anticoagulants," Abel, Rowntree, and Turner made their own (hirudin) from leeches in 1914 (34), and McLean found heparin in 1916 (35). But repair of vascular injuries was practically unknown in Army hospitals until the Korean War, when antibiotics and blood were plentiful.

What about *elective* operations on blood vessels in civilian life—ones that could be performed under sterile conditions in clean, aseptic operating rooms? Some say, "But we had no angiography (radiographs of arteries) to locate the obstructions precisely." Actually, radiographic visualization of the aorta and carotids began in 1927-29, at least 18 years before vascular surgery.

Maybe no one knew of Carrel's work on animals? Did he write in a little-known language? He was French-born, and some of his early papers are in French, but the great majority were written in good English. Maybe he worked in an obscure laboratory? No. He worked in one of the best known and most highly respected scientific laboratories in the world—the Rockefeller Institute for Medical Research in New York City.

Maybe he was a recluse and allowed no one in his laboratory? He did discourage casual visitors, but among those whom he invited to his laboratory at the University of Chicago in 1905 to watch a demonstration of his surgical techniques were the top men in the American surgical profession: George

Crile, Rudolph Matas, John Murphy, and Harvey Cushing (36). In addition, Carrel lectured at Johns Hopkins Medical School in 1905 and met all the great surgeons at Hopkins and the University of Pennsylvania before he visited New York City.

Maybe he rarely published, and then only in little-read journals? No. His work on experimental vascular surgery was published in the *Journal of the American Medical Association* (18 articles), *Journal of Experimental Medicine* (25 articles), *Science* (7 articles), *Surgery, Gynecology and Obstetrics* (5 articles), *Annals of Surgery* (3 articles), *Transactions of the American Surgical Society* (3 articles), and in the *Bulletin of the Johns Hopkins Hospital* and *British Medical Journal*. And in its October 19, 1912 issue, *The Lancet* commented editorially as follows:

> And there is a further advance in the surgery of the blood vessels which is, perhaps, even more surprising. Carrel has shown that a portion of artery may be preserved in cold storage for several days or even weeks before transplantation, and yet it will live. Nay more, although as a rule the tissue of one animal will not grow in the body of an animal of a different species, yet Carrel has found that these portions of blood vessels of dogs can be transplanted from cold storage with success into the bodies of cats. None who have followed with interest these new advances in surgery can doubt that they contain immense possibilities *and the application to man of the methods learned in animals cannot be long delayed* [italics added].

Maybe his work was not highly regarded? No. He won the Nobel Prize in 1912 and, as the first scientist working in an American laboratory to win the Nobel Prize in Medicine, the award was duly headlined in American newspapers; in fact, Carrel first learned of the award by spotting his name in a newspaper headline. And even before then, the *New York Times* carried a story in its October 13, 1912 issue that read in part:

> It has been shown also for the first time that transplanted kidneys functionate, that an animal, having undergone a double nephrectomy and the transplantation of both kidneys, from another animal, can live normally for a few weeks, and that an animal which has undergone a double nephrectomy and the graft of one of his own kidneys can recover completely and live in perfect health for eight months at least. Finally, it has been demonstrated that a leg extirpated from a dog and substituted for the corresponding leg of another dog, heals normally (see [3]).

And other New York newspapers published leading articles on the Carrel-Guthrie work as early as 1906 (36).

Maybe the Nobel Committee awarded the prize to him for some esoteric or incomprehensible aspect of his work? No. The award was specifically for vascular surgery and transplantation of organs.

Of the vascular surgeons of the 1950s, only Hufnagel of Georgetown seems to have known of Carrel's work, and Carrel's collected papers and works are now in the Carrel Room in the Dahlgren Memorial Library at Georgetown University Medical Center. What about all the others? Harbison, a surgeon at Pittsburgh, summed it up succinctly in six words (36): "The great surgeons dropped the ball." I believe he's wrong. Carrel's work was never locked up; it was published and publicized widely. I'd say, "The great surgeons didn't drop the ball; they never had the ball because they never knew it was there."

Julius H. Comroe, Jr.

REFERENCES

1. Carrel, A.: in *Nobel Lectures in Physiology or Medicine, 1901-1921*, Elsevier, Amsterdam, 1967, pp. 437-466.
2. Soupault, R.: Alexis Carrel, Les Sept Couleurs, Paris, 1972.
3. Alexis Carrel, Papers of the Centennial Conference at Georgetown University, June 28, 1973, R. W. Chambers and J. T. Durkin, ed., Georgetown University, Washington, D.C., 1973.
4. Edwards, W. S., and Edwards, P. D.: Alexis Carrel, Visionary Surgeon, Charles C. Thomas, Springfield, Ill., 1974.
5. Jaboulay, M., and Briau, E.: Recherches expérimentales sur la suture et la greffe artérielles, Lyon Méd. 1896, *81*, 97-99.
6. Murphy, J. B.: Resection of arteries and veins injured in continuity—End-to-end suture—Experimental and clinical research, Med Rec. 1897, *51*, 73-88.
7. Dörfler, J.: Ueber Arteriennaht, Beitr Klin Chir, 1899, *25*, 781-825.
8. Payr, E.: Beiträge zur Technik der Blutgefäss— und Nervennaht nebst Mittheilungen über die Verwendung eines resorbirbaren Metalles in der Chirurgie, Arch Klin Chir, 1900, *62*, 67-93.
9. Matas, R.: An operation for the radical cure of aneurism based upon arteriorrhaphy, Ann Surg, 1903, *37*, 161-196.
10. Höpfner, E.: Ueber Gefässnacht, Gefässtransplantationen und Replantation von amputirten Extremitäten, Arch Klin Chir, 1903, *70*, 417-471.
11. Carrel, A.: La technique opératoire des anastomoses vasculaires et la transplantation des viscères, Lyon Méd. 1902, *98*, 859-864.
12. Guthrie, C. C.: On misleading statements, Science, 1909, *29*, 29-31.
13. Carrel, A., Dakin, H., Daufresne, J., Dehelly, P., and Dumas, M.: Traitement abortif de l'infection des plaies, Bull Acad Méd Paris, 1915, *74*, 361-368.
14. Carrel, A., and Guthrie, C. C.: Uniterminal and biterminal venous transplantations, Surg Gynecol Obstet, 1906, *2*, 266-286.
15. Rous, P., and Turner, J. R.: The preservation of living red blood cells in vitro. I. Methods of preservation, J Exp Med. 1916, *23*, 219-237; II. The transfusion of kept cells, J Exp Med. 1916, *23*, 239-248.
16. Carrel, A.: Latent life of arteries, J Exp Med. 1910, *12*, 460-486.
17. Carrel, A.: The preservation of tissues and its applications in surgery, JAMA, 1912, *59*, 523-527.
18. Malt, R. A., and McKhann, C. F.: Replantation of severed arms, JAMA, 1964, *189*, 716-722.
19. Carrel, A., and Guthrie, C. C.: The transplantation of veins and organs, Am Med, 1905, *10*, 1101-1102.
20. Carrel, A.: The surgery of blood vessels, etc., Bull Johns Hopkins Hosp, 1907, *18*, 18-28.
21. Erdmann, J.: Serial determinations of myocardial water content in heterotopic canine heart transplants, personal communication; manuscript in preparation.
22. Carrel, A.: On the experimental surgery of the thoracic aorta and the

heart, Ann Surg, 1910, *52,* 83-95.
23. Favaloro, R. G.: Saphenous vein autograft replacement of severe segmental coronary artery occlusion: Operative technique, Ann Thorac Surg, 1968, *5,* 334-339.
24. Garrett, H. E., Dennis, E. W., and Debakey, M. E.: Aortocoronary bypass with saphenous vein graft, JAMA, 1973, *223,* 792-794.
25. Carrel, A.: Experimental operations on the sigmoid valves of the pulmonary artery, J Exp Med, 1914, *20,* 9-18.
26. Tuffier, T., and Carrel, A.: Patching and section of the pulmonary orifice of the heart, J Exp Med, 1914, *20,* 3-8.
27. Carrel, A.: Present condition of a strain of connective tissue twenty-eight months old, J Exp Med, 1914, *20,* 1-2.
28. Carrel, A., and Burrows, M. T.: Human sarcoma cultivated outside of the body, JAMA, 1910, *55,* 1732.
29. Carrel, A., and Lindbergh, C. A.: The Culture of Organs, Hoeber, New York, 1938.
30. Belzer, F. O., Ashby, B. S., and Dunphy, J. E.: 24-hour and 72-hour preservation of canine kidneys, Lancet, 1967, *2,* 536-539.
31. Lindbergh, C. A.: Apparatus to circulate liquid under constant pressure in a closed system, Science, 1931, *73,* 566.
32. Gross, R. E., Hurwitt, E. S., Bill, A. H., and Peirce, E. C., II: Preliminary observations on the use of human arterial grafts in the treatment of certain cardiovascular defects, N Engl J Med, 1948, *239,* 578-579.
33. Cruikshank, W.: The Anatomy of the Absorbing Vessels of the Human Body, Nicol, London, 1790.
34. Abel, J. J., Rowntree, L. G., and Turner, B. B.: On the removal of diffusible substances from the circulating blood of living animals by dialysis, J Pharmacol Exp Ther, 1914, *5,* 275-316.
35. McLean, J.: The thromboplastic action of cephalin, Am J Physiol, 1916, 41, 250-257.
36. Harbison, S. P.: Origins of vascular surgery: The Carrel-Guthrie letters, Surgery, 1962, *52,* 406-418.

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Involves the initial assessment of a 35-year-old male with a history of allergic asthma. Low flow oxygen is administered initially, followed by bronchodilator therapy. As the simulation progresses, the patient is intubated and receives mechanical ventilation. The user is required to make initial settings and adjustments according to ABG results and patient response. Also included in the simulation is a switch to IMV mode, sedation, and eventual extubation and placement on a 40 percent aerosol mask.

Item SP12 $65

Drug Overdose Simulation

This simulation involves an 18-year-old male entering the ER intoxicated, with a possible drug overdose. The user performs initial assessment that includes ventilatory parameters. During the course of the simulation, the patient is transferred to the ICU for further monitoring, then deteriorates and requires oxygen therapy via a 40 percent T-piece and mechanical ventilation. The patient is gradually weaned and extubated with supplemental oxygen therapy.

Item SP13 $65

Chronic Obstructive Pulmonary Disease (COPD) Simulation

The user is asked to perform initial assessment and pulmonary function studies on a patient with chronic lung disease. Then, the user classifies the patient's disease as mild, moderate, severe restrictive, and/or obstructive disease. The simulation asks for home care and home equipment cleaning recommendations. Three months later the patient enters the ER with respiratory distress, requiring initial evaluation and therapy.

Item SP14 $65

Acute Respiratory Distress Syndrome (ARDS) Simulation

This simulation presents a 30-year-old male 36 hours after emergency surgery for excision of a large duodenal ulcer; the patient is now restless and complaining of dyspnea. The simulation proceeds through initial oxygen therapy, followed by increasing F_{IO_2}, and then CPAP. The patient is eventually intubated and placed on a mechanical ventilator, where deteriorating ABGs and static compliance call for increasing PEEP, which is gradually increased to 25 cmwp. ABGs, compliance, and shunt studies are used to evaluate the effectiveness of the PEEP therapy.

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Epiglottitis Simulation

Presents a 4-year-old female entering the ER with a "cold" and elevated temperature. A lateral neck x-ray reveals massive edema of the epiglottis, whereupon the child is taken to surgery and intubated. The user is asked to recommend appropriate airway and size for the patient. After further assessment, CPAP is initiated with room air, and two days later the patient is evaluated for extubation and postextubation therapy.

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Premature Neonate Simulation

Includes initial assessment of a 15-year-old, high-risk, pregnant female upon admission and initial assessment of the baby after birth. APGAR scores of 4 and 3 are obtained in the assessment, and the simulation proceeds through adjustment of CPAP and F_{IO_2} for the infant. The infant does not receive mechanical ventilation and is eventually assessed for extubation, extubated, and given supplemental oxygen.

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Head Trauma Simulation

Simulates the initial evaluation and recommendations for care of a 25-year-old involved in a motor vehicle accident. After evaluation in the ER, the patient is taken to the OR for a craniotomy. Assessment following surgery (including measurement of ICP) indicates the need for CMV, whereupon the user is required to evaluate the effect of CMV, hyperinflation, and ET suctioning on ICP and take appropriate steps to maintain a normal ICP.

Item SP18 $65

Muscular Dystrophy Simulation

This is a simulation of a 10-year-old with diagnosed muscular dystrophy who is entering the ER with respiratory distress. The simulation asks for patient assessment and initial therapy recommendations. Diagnostic tests are then presented to evaluate the degree of muscle involvement, and the user is required to recommend further therapy based on the results of these tests. As the simulation progresses, IPPB is required and the user is asked to provide instructions to the patient on IPPB treatment. CPT is also involved, with the correct positioning of the patient required.

Item SP19 $65

Chest Trauma II Simulation

Involves a motor-vehicle-accident patient with multiple trauma. Initial assessment followed by oxygen therapy occurs in the ER, followed by further assessment leading to intubation and placement on a mechanical ventilator. Based on blood gas results, several ventilator changes are made. The patient suffers a pneumothorax while on the ventilator, and the user is required to assess and recommend treatment for the condition. In addition, the simulation includes measurement and clinical application of compliance.

Item SP110 $65

Neonate II Simulation

Begins with the assessment of a neonate delivered by C-section who is receiving oxygen in an incubator. Based on the assessment, the infant in intubated and placed on CPAP, but problems occur, requiring extubation and bag ventilation. After reintubation, the CPAP level is changed based on ABG results and the user is required to evaluate the infant for extubation. In the simulation, the patient then fails the procedure and the user must evaluate the patient to determine the cause of the problem, which is diagnosed as a diaphragmatic hernia.

Item SP111 $65

Cystic Fibrosis Simulation

This simulation presents a 13-year-old patient with cystic fibrosis in the outpatient clinic. The initial task is to perform a pulmonary assessment, after which a decision must be made concerning action to be taken based on the assessment. Following obtainment of additional diagnostic information, the patient is admitted, but the user is asked to set up a regimen of home care therapy, including recommendations about chest physiotherapy, oxygen therapy, aerosol therapy, and disinfecting home care equipment. The child is admitted two weeks later for further assessment and recommendations regarding treatment.

Item SP112 $65

Pulmonary Rehabilitation Simulation

Presents a 65-year-old woman admitted to the ER with progressive shortness of breath over two days. Initial assessment reveals evidence of chronic lung disease, an ABG sample is obtained, and oxygen therapy is initiated. Further evaluation, including lab values, is initiated following the initial therapy. Based on the lab values, an SVN with bronchodilator and chest physiotherapy is begun. During the administration of CPT, the patient becomes breathless while making vigorous inspiratory effort. CPR is initiated, resulting in a successful resuscitation. Three days later, the user is asked to evaluate and classify the severity of the patient's lung disease and to develop a home care plan.

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ESSENTIAL CONTENT ELEMENTS

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Case report. Abstract *must* report a case that is uncommon or of exceptional educational value and must include (1) Introduction: relevant basic information important to understanding the case. (2) Case Summary: patient data and response, details of interventions. (3) Discussion: content should reflect results of literature review. The author(s) should have been actively involved in the case and a case-managing physician must be a co-author or must approve the report.

FORMAT AND TYPING INSTRUCTIONS

Accepted abstracts will be photographed and reduced by 40%; therefore, the size of the original text should be *at least* 10 points. *Abstracts should be 400 words or less and may have 1 clear, concise table or figure.* A font like Helvetica or Geneva makes the clearest reproduction. The first line of the abstract should be the title in all capital letters. Title should explain content. Follow title with names of all authors (including credentials), institution(s), and location; underline presenter's name. Type or electronically print the abstract *single spaced in a single paragraph in the space provided on the abstract blank.* Insert only one letter space between sentences. Text submission on diskette is encouraged but must be accompanied by a hard copy. Identifiers will be masked (blinded) for review. *Data may be submitted in table form, or a simple figure may be included provided it fits within the space allotted. No figure, illustration, or table is to be attached to the abstract form.* Provide all author information requested. A clear photocopy of the abstract form may be used. Standard abbreviations may be employed without explanation; new or infrequently used abbreviations should be spelled out on first use. Any recurring phrase or expression may be abbreviated, if it is first explained. Check the abstract for (1) errors in spelling, grammar, facts, and figures; (2) clarity of language; and (3) conformance to these specifications. An abstract not prepared as requested may not be reviewed. Questions about abstract preparation may be telephoned to the editorial staff of Respiratory Care at (972) 406-4667.

Early Deadline Allowing Revision. Authors may choose to submit abstracts early. Abstracts postmarked by February 16, 1998 will be reviewed and the authors notified by letter only to be mailed by March 20, 1998. Rejected abstracts will be accompanied by a written critique that should, in many cases, enable authors to revise their abstracts and resubmit them by the Final Deadline (May 4, 1998).

Final Deadline. The mandatory Final Deadline is May 4, 1998 (postmark). Authors will be notified of acceptance or rejection *by letter only*. These letters will be mailed by July 20, 1998.

Mailing Instructions. Mail (do not fax!) 2 clear copies of the completed abstract form, diskette (if possible), and a stamped, self-addressed postcard (for notice of receipt) to:

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Dallas TX 75229-4593

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2. Follow title with all authors' names, including credentials (underline presenter's name), institution, and location.
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5. All text and the table, or figure, must fit into the rectangle shown. (Use only 1 clear, concise table or figure.)
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Manuscript Preparation Guide

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Evaluation of Device/Method/Technique: A description and evaluation of an old or new device, method, technique, or modification. It has a Title Page, Abstract, Introduction, Description of Device/Method/Technique, Evaluation Methods, Evaluation Results, Discussion, Conclusions, Product Sources, Acknowledgments, References, Tables, Appendices, Figures, and Figure Captions. Comparative cost data should be included wherever possible.

Case Report: A report of a clinical case that is uncommon, or was managed in a new way, or is exceptionally instructive. All authors must be associated with the case. A case-managing physician must either be an author or furnish a letter approving the manuscript. Its components are Title Page, Abstract, Introduction, Case Summary, Discussion, References, Tables, Figures, and Figure Captions.

Review Article: A comprehensive, critical review of the literature and state-of-the-art summary of a pertinent topic that has been the subject of at least 40 published research articles. Title Page, Outline, Introduction, Review of the Literature, Summary, Acknowledgments, References. Tables, Appendices, and Figures and Captions may be included.

Overview: A critical review of a pertinent topic that has fewer than 40 published research articles.

Update: A report of subsequent developments in a topic that has been critically reviewed in this Journal or elsewhere.

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Editorial: A paper drawing attention to a pertinent concern; it may present an opposing opinion, clarify a position, or bring a problem into focus.

Letter: A signed communication, marked "For publication," about prior publications in this Journal or about other pertinent topics. Tables and illustrations may be included.

Blood Gas Corner: A brief, instructive case report involving blood gas values—with Questions, Answers, and Discussion.

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Kittredge's Corner: A brief description of the operation of respiratory care equipment—with information from manufacturers and editorial comments and suggestions.

PFT Corner: Like Blood Gas Corner, but involving pulmonary function tests.

Cardiorespiratory Interactions. A case report demonstrating the interaction between the cardiovascular and respiratory systems. It should be a patient-care scenario; however, the case—the central theme—is the systems interaction. CRI is characterized by figures, equations, and a glossary. See the March 1996 Issue of RESPIRATORY CARE for more detail.

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Review of Book, Film, Tape, or Software: A balanced, critical review of a recent release.

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Print on one side of white bond paper, 8.5 in. x 11 in. (216 x 279 mm) with margins of at least 1 in. (25 mm) on all sides of the page. Use ***double-spacing*** throughout the ***entire*** manuscript. Use a standard font (eg, Times, Helvetica, or Courier) at least 10 points in size, and

do not use italics except for special emphasis. Number all pages in upper-right corners. Indent paragraphs 5 spaces. Do ***not justify***. **Do *not* put authors' names, institutional affiliations or allusions to institutional affiliations in the text, or other identification anywhere except on the title page.** Repeat title only (no authors) on the abstract page. Begin each of the following on a new page: Title Page, Abstract, Text, Product Sources List, Acknowledgments, References, each Table, and each Appendix. Use standard English in the first person and active voice.

Center main section headings on the page and type them in capital and small letters (eg, Introduction, Methods, Results, Discussion). Begin subheadings at the left margin and type them in capital and small letters (eg, Patients, Equipment, Statistical Analysis).

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Article in a journal carrying pagination throughout volume:

> Rau JL, Harwood RJ. Comparison of nebulizer delivery methods through a neonatal endotracheal tube: a bench study. Respir Care 1992;37(11):1233-1240.

Article in a publication that numbers each issue beginning with Page 1:

> Bunch D. Establishing a national database for home care. AARC Times 1991;15(Mar):61,62,64.

Corporate author journal article:

> American Association for Respiratory Care. Criteria for establishing units for chronic ventilator-dependent patients in hospitals. Respir Care 1988;33(11):1044-1046.

Article in journal supplement: (Journals differ in their methods of numbering and identifying supplements. Supply sufficient information to promote retrieval.)

> Reynolds HY. Idiopathic interstitial pulmonary fibrosis. Chest 1986; 89(3 Suppl):139S-143S.

Abstract in journal: (Abstracts citations are to be avoided. Those more than 3 years old should not be cited.)

> Stevens DP. Scavenging ribavirin from an oxygen hood to reduce environmental exposure (abstract). Respir Care 1990;35(11): 1087-1088.

Editorial in journal:

> Enright P. Can we relax during spirometry? (editorial). Am Rev Respir Dis 1993;148(2):274.

Editorial with no author given:

> Negative-pressure ventilation for chronic obstructive pulmonary disease (editorial). Lancet 1992;340(8833):1440-1441.

Letter in journal:

> Aelony Y. Ethnic norms for pulmonary function tests (letter). Chest 1991;99(4):1051.

Paper accepted but not yet published:

> Hess D. New therapies for asthma. Respir Care (year, in press).

Personal author book: (For any book, specific pages should be cited whenever possible.)

> DeRemee RA. Clinical profiles of diffuse interstitial pulmonary disease. New York: Futura; 1990. p. 76-85.

Corporate author book:

> American Medical Association Department of Drugs. AMA drug evaluations, 3rd ed. Littleton CO: Publishing Sciences Group; 1977.

Chapter in book with editor(s):

> Pierce AK. Acute respiratory failure. In: Guenter CA, Welch MH, editors. Pulmonary medicine. Philadelphia: JB Lippincott; 1977:26-42.

Tables. Use consecutively numbered tables to display information. Start each table on a separate page. Number and title the table and give each column a brief heading. Place explanations in footnotes, including all nonstandard abbreviations and symbols. Key the footnotes with conventional designations (*, †, ‡, §, ‖, ¶, **, ††) in consistent order, placing them superscript in the table body. Do not use horizontal or vertical rules or borders. Do not submit tables as photographs, reduced in size, or on oversize paper. Use the same typeface as in the text.

Illustrations. Graphs, line drawings, photographs, and radiographs are figures. Use only illustrations that clarify and augment the text. Number them consecutively as Fig. 1, Fig. 2, and so forth according to the order by which they are mentioned in the text. Be sure all figures are cited. If any figure was previously published, include copyright holder's written permission to reproduce. Figures for publication must be of professional quality. Data for the original graphs should be available to the Editor upon request. If color is essential, consult the Editor for more information. In reports of animal experiments, use schematic drawings, not photographs. A letter of consent must accompany any photograph of a person. Do not place titles and detailed explanations on figures; put this information in figure captions. If possible, submit radiographs as prints and full-size copies of film.

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Ethics. When reporting experiments on human subjects, indicate that procedures were conducted in accordance with the ethical standards of the *World Medical Association Declaration of Helsinki* [Respir Care 1997;42(6):635-636] or of the institution's committee

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THE FDA MEDICAL PRODUCTS REPORTING PROGRAM

For VOLUNTARY reporting by health professionals of adverse events and product problems

Page ____ of ____

Form Approved: OMB No. 0910-0291 Expires: 4/30/96
See OMB statement on reverse

FDA Use Only (Resp Care)

Triage unit sequence #

A. Patient information

Patient identifier / In confidence

2. Age at time of event: ____ or Date of birth: ____

3. Sex: ☐ female ☐ male

4. Weight: ____ lbs or ____ kgs

B. Adverse event or product problem

☐ Adverse event and/or ☐ Product problem (e.g., defects/malfunctions)

Outcomes attributed to adverse event (check all that apply)

☐ death ____ (mo/day/yr)
☐ life-threatening
☐ hospitalization – initial or prolonged
☐ disability
☐ congenital anomaly
☐ required intervention to prevent permanent impairment/damage
☐ other: ____

Date of event (mo/day/yr)

4. Date of this report (mo/day/yr)

Describe event or problem

Relevant tests/laboratory data, including dates

Other relevant history, including preexisting medical conditions (e.g., allergies, race, pregnancy, smoking and alcohol use, hepatic/renal dysfunction, etc.)

C. Suspect medication(s)

1. Name (give labeled strength & mfr/labeler, if known)
#1
#2

2. Dose, frequency & route used
#1
#2

3. Therapy dates (if unknown, give duration) from/to (or best estimate)
#1
#2

4. Diagnosis for use (indication)
#1
#2

5. Event abated after use stopped or dose reduced
#1 ☐ yes ☐ no ☐ doesn't apply
#2 ☐ yes ☐ no ☐ doesn't apply

6. Lot # (if known)
#1
#2

7. Exp. date (if known)
#1
#2

8. Event reappeared after reintroduction
#1 ☐ yes ☐ no ☐ doesn't apply
#2 ☐ yes ☐ no ☐ doesn't apply

9. NDC # (for product problems only)
– –

10. Concomitant medical products and therapy dates (exclude treatment of event)

D. Suspect medical device

1. Brand name

2. Type of device

3. Manufacturer name & address

4. Operator of device
☐ health professional
☐ lay user/patient
☐ other: ____

5. Expiration date (mo/day/yr)

6.
model # ____
catalog # ____
serial # ____
lot # ____
other #

7. If implanted, give date (mo/day/yr)

8. If explanted, give date (mo/day/yr)

9. Device available for evaluation? (Do not send to FDA)
☐ yes ☐ no ☐ returned to manufacturer on ____ (mo/day/yr)

10. Concomitant medical products and therapy dates (exclude treatment of event)

E. Reporter (see confidentiality section on back)

1. Name & address

phone #

2. Health professional?
☐ yes ☐ no

3. Occupation

4. Also reported to
☐ manufacturer
☐ user facility
☐ distributor

5. If you do NOT want your identity disclosed to the manufacturer, place an " X " in this box. ☐

FDA

Mail to: MEDWATCH, 5600 Fishers Lane, Rockville, MD 20852-9787 or FAX to: 1-800-FDA-0178

FDA Form 3500 1/96)

Submission of a report does not constitute an admission that medical personnel or the product caused or contributed to the event.

ADVICE ABOUT VOLUNTARY REPORTING

Report experiences with:

- medications (drugs or biologics)
- medical devices (including in-vitro diagnostics)
- special nutritional products (dietary supplements, medical foods, infant formulas)
- other products regulated by FDA

Report SERIOUS adverse events. An event is serious when the patient outcome is:

- death
- life-threatening (real risk of dying)
- hospitalization (initial or prolonged)
- disability (significant, persistent or permanent)
- congenital anomaly
- required intervention to prevent permanent impairment or damage

Report even if:

- you're not certain the product caused the event
- you don't have all the details

Report product problems – quality, performance or safety concerns such as:

- suspected contamination
- questionable stability
- defective components
- poor packaging or labeling
- therapeutic failures

How to report:

- just fill in the sections that apply to your report
- use section C for all products except medical devices
- attach additional blank pages if needed
- use a separate form for each patient
- report either to FDA or the manufacturer (or both)

Important numbers:

- 1-800-FDA-0178 to FAX report
- 1-800-FDA-7737 to report by modem
- 1-800-FDA-1088 to report by phone or for more information
- 1-800-822-7967 for a VAERS form for vaccines

If your report involves a serious adverse event with a device and it occurred in a facility outside a doctor's office, that facility may be legally required to report to FDA and/or the manufacturer. Please notify the person in that facility who would handle such reporting.

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Calendar of Events

AARC & AFFILIATES

March 4–5 — Rhode Island Society
The 14th Annual Newport Challenge at the Newport Islander Doubletree Hotel on Goat Island, Newport, Rhode Island.
Contact: Wayne Forest at (401) 769-8758 or Len Duffy at (401) 737-7010, ext 1672.

May 3–5 — Washington Society
The 25th Annual Pacific Northwest Regional Respiratory Care Conference to be held at Cavanaughs Inn at the Park, Spokane, Washington. Neil R MacIntyre MD will be a featured speaker.
Contact: Jan Tucker at (800) 464-2126.

May 12–15 — Region II for Respiratory Care
The 25th Annual Region II Conference for the state affiliates of Ohio, Indiana, and Kentucky in Cincinnati, Ohio.
Contact: (800) 691-3046, Mail Box #1, or visit the Region II web site at http://www.bright.net/~dsibb/reg2rc.htm.

OTHER MEETINGS

April 9–10 — InfoCare
The Annual Adult Respiratory/Critical Care Symposium at the Sheraton Fiesta Beach Resort in South Padre Island, Texas.
Contact: InfoCare at (956) 233-5645 or fax (956) 233-1010.

April 15–18 — All Children's Hospital of St Petersburg
"Transport Team Survival in the 21st Century," a Neonatal/Pediatric Transport Conference, held in Clearwater Beach, Florida.
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Contact: Connie Spadaccino at (813) 892-4240, (800) 456-4543, ext. 4240, or fax (813) 892-4399.

May 8–10 — Medical University of South Carolina ECMO Service
The 8th annual Southeastern ECMO Conference at the Frances Marion Hotel, Charleston, South Carolina.
Contact: Sandra Ballard at (803) 792-9941.

August 3–7 — American Society of Electroneurodiagnostic Technologists & the Association of Polysomnographic Technologists
The 39th Annual Convention at the Sheraton Hotel in New Orleans, Louisiana. Abstracts are accepted through March.
Contact: ASET executive office at (712) 792-2978, fax (712) 792-6962, e-mail: aset@netins.net or visit their web site at www.aset.org.

August 27–28 — Cleveland Clinic Foundation
Horizons in Pulmonary & Critical Care Medicine held at the Cleveland Clinic's Bunts Auditorium, Cleveland, Ohio.
CRCE: Has been approved for Category 1 accreditation.
Contact: (800) 762-8173, (216) 444-5695, or fax (216) 445-9406.

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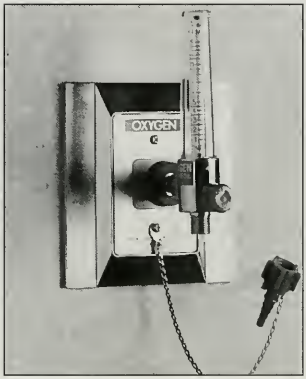
BLOOD PRESSURE (BP) MONITOR. The Accutracker, produced by SunTech Medical Instruments, gathers a series of BP readings during a patient's normal routine. By implementing the auscultatory technique with R-wave gating, the monitor can reduce the effects of patient motion to gather accurate data, acording to a SunTech press release. Accutracker monitors several factors: systolic and diastolic pressures, heart rate, time period averages, and blood pressure load. The data may be downloaded to SunTech's Accuwin reporting software for interpretation and diagnosis. A variety of applications include episodic hypertension, evaluation of drug resistance, and evaluation of BP changes in nocturnal angina. For more information about ambulatory BP technology, circle number 160 on the Reader Service Card.

FUME CONTROL SYSTEMS. PCI Medica Inc introduces new wall-mounted systems designed for smaller spaces where full-size glutaraldehyde fume hoods are not an option. According to a press release from PCI, a baffle system produces a laminar flow across the soaking bowl to safely draw fumes away from the operator into a neutralizing filter. Five models range in size from 18.5 in. to 51 in. and are available with an optional floor switch for hands-free operation. For complete technical specifics, circle Reader Service Number 161.



OXYGEN MOUNTING SYSTEM. Designed for vigorous use in a variety of applications, the Omniox line of equipment is useful in settings where speedy access to oxygen is critical. Produced by Doxx Technology Services Inc, this time-saving family of products features stainless steel construction and exclusive pressure terminal ring connectors. The entire line is compatible with many typical flowmeters, regulators, and cylinder wrenches, and custom configurations are available. For more details, circle Reader Service Number 162.

EDUCATION PRODUCTS. The National Association for Medical Equipment Services (NAMES) announces the availability of 3 education products: *NAMES 1997 Industry Survey: Reimbursement Strategies for Home Medical Equipment in Managed Care*, a manual; and *Building an HME Network for Managed Care Success*, a workbook. A NAMES press release claims the *Survey* provides insight into the fiscal growth of health care industries; that the manual explores reimbursement issues for home health care; and that the workbook offers guides for developing marketing goals for new home care networks. NAMES members receive a discount on these materials. For pricing details, order forms, or Fax-on-Demand information, circle Reader Service Number 163.

LACTATE MONOGRAPH. Nova Biomedical publishes *Review of Diagnostic Uses of Lactate in Critical Care*. The 30-page monograph cites 236 references, reviews oxygen and lactate dynamics, interprets lactate measures and causes of elevated lactate, and compares lactate with other markers. Nova claims that the monograph is a resource for use in a variety of emergency and critical care situations, such as acute myocardial infarction, acute respiratory distress syndrome, chronic obstructive pulmonary disease, respiratory therapy, surgery, and trauma. For a free copy of the monograph, circle Reader Service Number 164.

ORAL SPRAY FOR SMOKERS. MGA Development Corp (an affiliate of HealthScan Inc) introduces Citrol™ Oral Spray, a dietary supplement formulated as an alternative to smoking. Designed for use in the workplace, restaurants, hotels, air-

planes, and other smoke-free environments, the pocket-sized spray can help individuals cope with immediate cravings by simulating the tracheal sensations produced by cigarette smoke. The main ingredient, citric acid, can temporarily reduce the desire to smoke, without using nicotine or stimulants, according to claims made in an MGA press release. Circle Reader Service Number 165 for more information.

OXIMETER WITH WAVEFORM. NPB -195 Pulse Oximeter with Plethysmographic Waveforms is now available from Nellcor Puritan Bennett. The company says that the NPB-195 features an easy-to-read liquid-crystal display for viewing plethysmographic waveforms and up to 24 hours of patient trend data. In addition, the oximeter features an internal power supply, printing capabilities, audible and visible alarms for high-low saturation and pulse rate. To meet multilingual needs, the software is capable of configuring in English, French, Spanish, Italian, Dutch, Portuguese, and German. For more information from Nellcor about the oximeter, circle Reader Service Number 166.

SOFTWARE UPDATE. Principia Products Inc releases the updated Remark Office OMR Version 4.0 software. According to Principia, the new version is more flexible and easier to use. Remark is available for use with Windows 3.1, Windows 95, and Windows NT. Furthermore, the company says that the software supports more than 30 output formats, including Access, Excel, and Fox Pro. More training features, wider flexibility for answer keys and test points, and extended options for student reports are also added. For details, circle Reader Service Number 167.

Policy and Procedure Manual

Save time and money by making your department more efficient with the *Policy and Procedure Manual.* Its 130 pages of policies and procedures cover the aspects of administrative and clinical respiratory care for both adult and pediatric practice. Sections on administrative policies, therapeutics, clinical monitoring, and mechanical ventilation. Standardized formats include objectives, indications, equipment, policies, contraindications, troubleshooting, procedures, hazards, and assessment of effectiveness.

Item BK6 $60 ($70 nonmembers)

Uniform Reporting Manual

The *Uniform Reporting Manual* provides you with nationally recognized standards for documenting workload units and time standards. Includes patient assessment activities and covers bronchial hygiene, supplemental oxygen, airway care, diagnostic tests, and cardiovascular diagnostics. In addition, there are chapters on "Clinical Activities Without Time Standard" and "Management Support Activities." *By the AARC. 1990, updated 1993. Binder, 165 pages.*

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Respiratory Home Care Equipment exclusively covers home care equipment with practical applications and charts on oxygen concentrators, liquid units, air compressors, and home care ventilators. An invaluable book for the home care practitioner and equipment technician. Details home care devices, cleaning, disinfecting, and monitoring procedures to minimize infection. Includes guides for educating staff on equipment, therapy, patient assessment, and safety. Features procedures for gas administration and monitoring devices, humidifiers and nebulizers, artificial airways and resuscitators, respirators, and ventilators. *By Steven P. McPherson. Hardcover, 192 pages, 141 illustrations, 6 tables. 1988.*

Item BK7 $6 ($12 nonmembers)

A Study of Chronic Ventilator Patients in the Hospital

Chronic ventilator-dependent patients are costing American hospitals more than $9 million per day according to this Gallup study conducted for the AARC. This important study provides information on patients who depend on life-support systems; why, how, and where they are being treated; and the cost of treatment. *47 pages, 9 tables, 12 figures.*

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The AARC Human Resources Survey: A Study of Respiratory Care Human Resourceslin Hospitals

Covers a wide range of human resource issues, including compensation, numbers of full-time equivalents, job vacancy rates, education, credentialing, and licensure. Even includes information on age, sex, and years of experience. Includes comprehensive summary, position profiles, salaries, education, experience, credentials, and regional demographics. Vacancies are inventoried. *68 pages, 66 tables.*

Item BK12 $35 ($50 nonmembers)

A Study of Respiratory Care Practice

This study examines the practice of respiratory care in today's health care environment and how hospital reorganization is affecting the profession. Includes chapters on medical direction, current respiratory care services, nontraditional services, respiratory care protocols, and hospital service reorganization. *38 pages, 34 tables, 15 charts.*

Item BK17 $20 ($40 nonmembers)

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1998 Health Outcomes Research Grants Available from Hoechst Marion Roussel

Researchers may apply for $5,000 to $100,000 grants to fund, in full or in part, outcomes research. The grants, for research in cardiovascular diseases, neurosciences, oncology, respiratory diseases, endocrinology, rheumatology, and infectious diseases, are available from Hoechst Marion Roussel.

To be eligible for the 1998 ACCORD (A Company-Wide Commitment to Outcomes Research & Development) Grants, research must advance knowledge in health outcomes research or investigate health outcomes research issues related to a specific therapeutic domain or product or a specific therapeutic domain or product compared to another intervention. Grants are evaluated on a variety of criteria including scientific merit and contribution to the health care system and to society.

For an application, call (800) 867-7001. Completed applications must be received by May 1, 1998. Grants will be awarded in October.

New *Federal Register* Notices Now Available

The Center for Devices and Radiological Health announces the publication of new Facts-on-Demand FOD notices in the *Federal Register*. The new publications: FOD#774—Medical Devices; Preemption of State Product Liability Claims; Proposed Rule; FOD#607—Rebuilders, Reconditioners, Services, and "As Is" Remarketers of Medical Devices; Review and Revision of Compliance Policy Guides and Regulatory Requirements; Request for Comments and Information; Proposed Rule; and FOD#513—Medical Devices; Reports of Corrections and Removals; Stay of Effective Date of Information Collection Requirements; Stay of Effective Date of Final Regulation. For more information about Facts-on-Demand call (800) 899-0381 or (301) 826-0111. The FOD system is also on the Internet at www.fda.gov/cdrh/fedregin.html.

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The National Association for Medical Equipment Services (NAMES) announces its 1998 national conferences and regional education seminars. For information about upcoming events, call the NAMES Education & Meeting Department at (703) 836-6263, or visit the web site: www.names.org.

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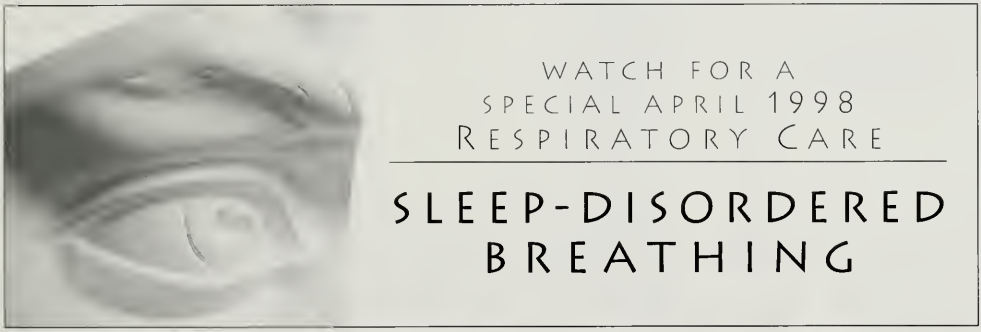
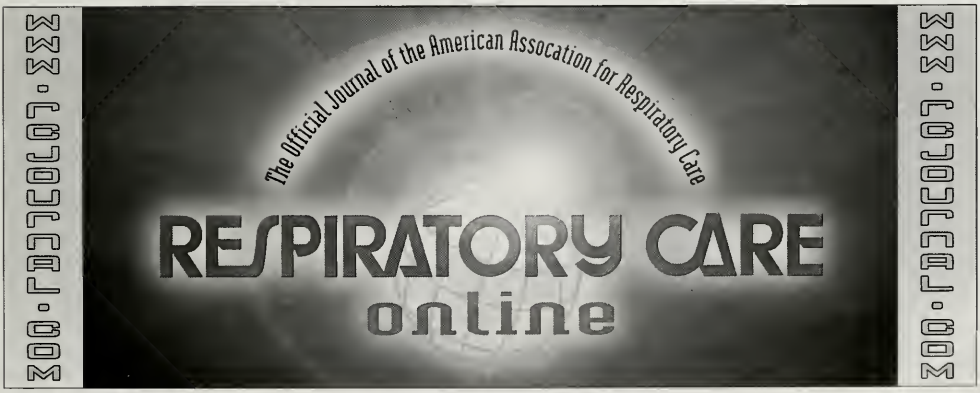
Examination	Examination Date	Examination Fee
CRTT Examination	July 11, 1998 Application Deadline: May 1, 1998	$ 100 (new applicant)* 60 (reapplicant)*
	November 14, 1998 Application Deadline: September 1, 1998	100 (new applicant)* 60 (reapplicant)*
RRT Examination	June 6, 1998 Application Deadline: February 1, 1998	120 Written only (new applicant) 80 Written only (reapplicant) 130 CSE only (all applicants)
	December 5, 1998 Application Deadline: August 1, 1998	250 Both (new applicant) 210 Both (reapplicant)
CPFT Examination	June 6, 1998 Application Deadline: April 1, 1998	130 (new applicant) 100 (reapplicant)
RPFT Examination	December 5, 1998 Application Deadline. September 1, 1997	180 (new applicant) 150 (reapplicant)
Perinatal/Pediatric Respiratory Care Specialty Examination	March 14, 1998 Application Deadline: November 1, 1998	180 (new applicant) 150 (reapplicant)

*In 1999, this examination fee will increase by $20.

For information about other services or fees, write to the National Board for Respiratory Care, 8310 Nieman Road, Lenexa KS 66214, or call (913) 599-4200, FAX (913) 541-0156,or e-mail: nbrc-info@nbrc.org





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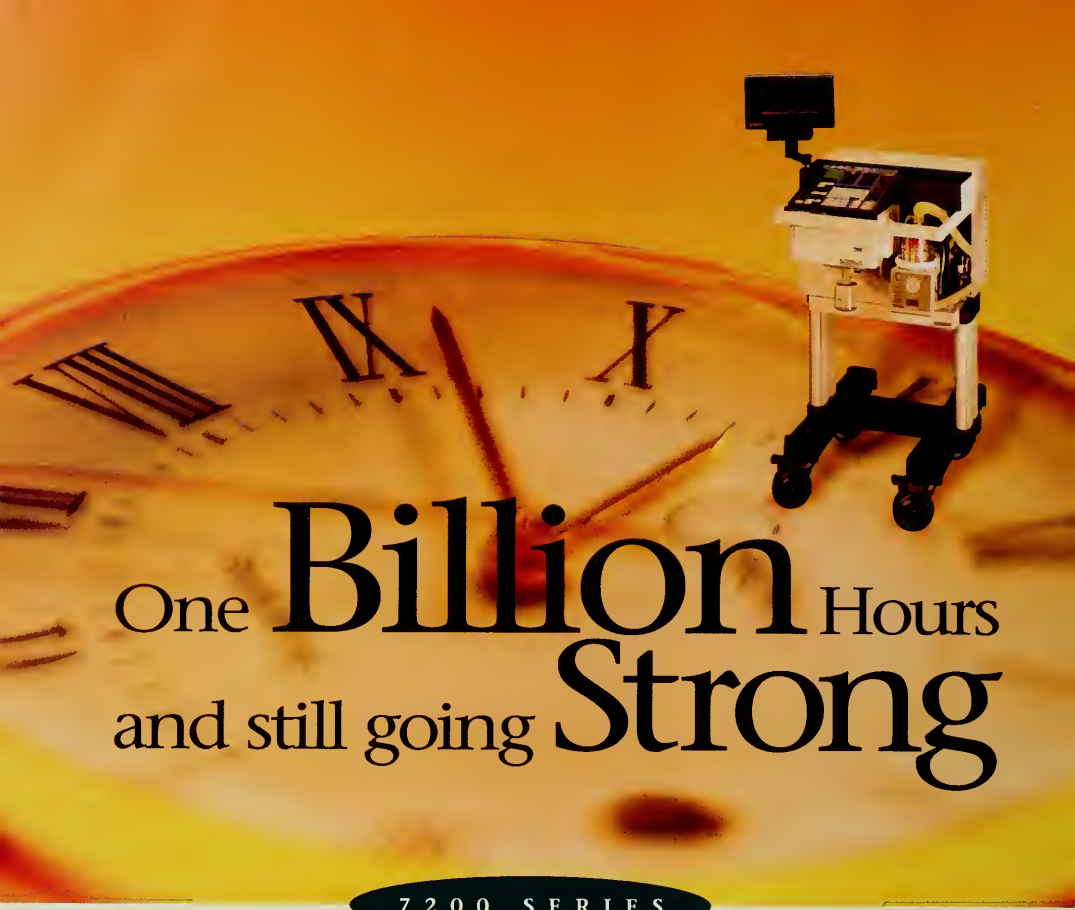

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